DETAILED ADMINISTRATION REPORTS OF SUBORDINATE OFFICERS OF THE DEPARTMENT OF AGRICULTURE MADRAS

FOR

1949–50

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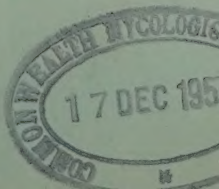

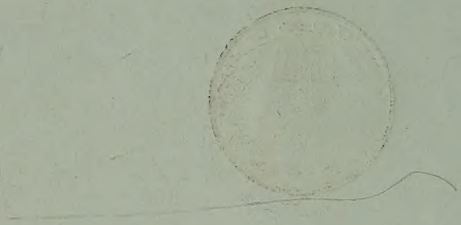

ADMINISTRATION REPORTS OF SUBORDINATE OFFICERS OF THE DEPARTMENT OF AGRICULTURE, MADRAS, FOR 1949–50.

DETAILED ANNUAL REPORT OF THE GOVERNMENT AGRICULTURAL CHEMIST FOR THE YEAR 1949–50.

I submit herewith the detailed report of work of the Government Agricultural Chemist's Section for the fasli year 1949–50.

Charge.—I continued to be in charge of the section almost throughout the year. I proceeded on a month's leave on average pay from 27th June 1950 and Sri M. Sanyasi Raju, the Agricultural Bacteriologist, was placed in full additional charge during the leave period.

Staff—(i) *Retirement.*—Dr. S. Kasinatha Ayyar, Deputy Director of Agriculture, Tungabhadra Project, Bellary, on reversion to his permanent post of Assistant Agricultural Chemist, joined duty on 18th November 1949 and after serving for a short period, proceeded on leave preparatory to retirement from 5th December 1949.

(ii) *Transfers.*—Sri G. K. Chidambaram, Assistant Agricultural Chemist, was relieved on 10th December 1949 to take up his new post as Inspector of Fertilizers, Madras.

(iii) *Leave.*—Sri T. Rajagopala Ayyengar, Gazetted Assistant in Chemistry, was granted privilege leave for a period of four months from 18th May 1950.

(iv) *Promotions.*—Sri C. Raghavendrachar, who was reverted to subordinate service on 18th November 1949 was again appointed to act temporarily as Assistant Agricultural Chemist from 19th April 1950 in the vacancy caused by the retirement of Dr. S. Kasinatha Ayyar. Sri T. S. Lakshmanan, Sri D. V. Krishna Rao and Sri P. Kunhirama Menon, Upper subordinates, were promoted temporarily to Gazetted rank as Assistant Agricultural Chemists. Consequent on the postponement of Scheme of Research on Palmyra to December 1950, Sri D. V. Krishna Rao, Assistant Agricultural Chemist in charge of the Scheme of Research on Palmyra from 19th May 1950, the date of commencement of the scheme was transferred to the main section as Gazetted Assistant in Chemistry in the leave vacancy reverting Sri P. Kunhirama Menon to subordinate service from 29th May 1950.

The post of Soil Physicist which had remained vacant since 1945 was filled up in April 1950. Sri F. L. Daniel, Assistant in Soil Physics, was appointed as Soil Physicist on probation from 17th April 1950.

As regards subordinate staff, there was no change.

Training.—Sri D. V. Krishna Rao and Sri C. R. Venkataramanan, Assistants, were deputed to undergo short course

training in Soil Survey and Land Utilization at the Indian Agricultural Research Institute, New Delhi, for periods of two and six months respectively from February 1950.

Study leave.—Sri A. Mariakulandai, Assistant, has proceeded to United States of America on study leave for eighteen months from 31st January 1950.

The work of the section may be conveniently reported under the three heads (I) Teaching, (II) Analytical and Advisory, and (III) Research.

I. Teaching.

Sri T. Rajagopala Ayyangar and Sri M. Sundaram assisted by three assistants continued to be primarily in charge of the Teaching. As in the previous year, members of the section with experience in particular branches of Agricultural Chemistry were deputed to take classes. Thus Agricultural Geology was dealt with by Sri C. Raghavendrachar, Soils by Sri G. K. Chidambaram and later by Sri P. Kunhirama Menon when the former was transferred to Madras, Dairy Chemistry by the Sri M. Sanyasi Raju, Lectures on Organic and Inorganic manures were delivered by me and Sri D. V. Krishna Rao respectively.

The number of lectures delivered and practical classes held during the year are given in the statement below :—

	Number of classes.	Hours.
B.Sc. (Ag.)—		
First year—		
Theory	60	60
Practical A and B batches ..	48	96
Practical C and D batches ..	44	88
Second year—		
Theory	52	52
Practical A and B batches	26	52
Practical C and D batches ..	26	52
Third year—		
Theory	129	129
Practical A and B batches ..	76	152
Practical C and D batches ..	72	144

Research students.—No students were admitted during the year. Sri S. Ramarajan who left after completing his research work in the previous year was awarded the degree of M.Sc. by the Madras University for his thesis on "Studies on the nature of phosphorus constituents of cultivated soils and their role in plant nutrition."

Special training.—Some of the Junior Gazetted Officers and Senior Assistants were given a course of lectures and practical training in microbiology.

II. Analytical and Advisory.

The analytical and advisory work constitutes the largest and one of the most important phases of the activities of this section. Sri G. K. Chidambaram was in charge till 10th December 1949 and on his transfer as Inspector of Fertilizers, Madras, Sri M. Sundaram was in full additional charge till 19th April 1950 when he was relieved by Sri T. S. Lakshmanan.

The activities of this branch of the section consisted mainly in the analysis of soils, manures, foodstuffs, fodders, irrigation waters, sugarcane, and other miscellaneous samples. The services of this section were fully utilized by ryots and the general public, manure firms, industrial concerns and officers of the Agricultural and other departments including Civil Supplies, Electricity, Irrigation, Cinchona and Public Works departments. It continued to do its useful work in answering numerous queries received on matters pertaining to improvement of soil fertility, manuring, feeding of livestock, irrigation waters and other problems relating to Grow More Food Campaign like reclamation, methods of development of saline lands and bringing new lands under cultivation. Two thousand four hundred and sixty-six samples of different descriptions were received and registered during the year. The number of samples analysed and reported on including arrears samples of last year totalled 2,766. These are classified below according to the nature of the samples and sources of receipt :—

Nature of sample.	Agricultural Department.	Other Government Departments.	Private.	Total.
Soils	604	38	92	734
Grains and straw	72	..	..	72
Manures	102	48	219	369
Foodstuffs	16	170	2	188
Plant products	1,048	2	1	1,051
Waters	113	8	9	130
Miscellaneous	173	47	2	222
Total ..	2,128	313	325	2,766

The receipts by way of analysis fees, chiefly realized from firms dealing in proprietary fertilizers, amounted to Rs. 2,862 as compared to Rs. 2,973 in the previous year.

The following are some of the items of important work done by the section for Government departments and the general public :—

(*a*) Thirteen samples of soil and one sample of sub-soil water collected from the lands of Sri S. A. Narayana Ayyangar in Sembodai village, Tiruthuraipundi taluk, Tanjore district, were examined and a treatment of flooding and drainage, followed by heavy applications of organic matter like casuarina needles, etc., was recommended as ameliorative measure for the reclamation of this saline area.

(*b*) Samples of condemned tinned foods like meat biscuits, bacon, ham, egg powder, and milk powder received from private firms were analysed for their manurial content and advice given regarding their suitability for use as manures.

(*c*) To ascertain the effect of storage on the hydrocyanic acid content of Burma beans a sample from the stock in the custody of the District Health Officer, Coimbatore, was obtained and examined. Storage had not appreciably diminished the HCN content.

(*d*) Five samples of Burma beans received from the Municipal Health Officer, Coimbatore, were found to contain toxic amounts (over 350 parts per million) of hydrocyanic acid. Of the various treatments tried the following were found to reduce the HCN content to well below toxic limits: (i) soaking overnight in water, draining and boiling for two hours with the addition of a small amount of acetic acid and finally neutralising the acid with lime water; (2) soaking overnight in water, draining and boiling, 30 minutes each time, in two changes of water, after removing the seed coat after the first boiling. Although the treatments have been successful in making the Burma beans safe for human consumption, it is doubtful whether the public could be trusted to adopt the method safely.

(*e*) In connexion with the Hagari-Bommanahalli project six samples of soil were examined for water soluble salts and the results reported to the Special Executive Engineer, Public Works Department, Anantapur.

(*f*) Soil profile samples taken from the site proposed for the sewage farm, Mettupalayam Municipality, were analysed and the site was recommended as suitable for the purpose.

(*g*) Two samples of burnt limestone received from the Assistant Engineer, Public Works Department, Courtalam, and intended for use in the construction of Tungabhadra Dam were examined and the hydraulic index worked out.

(*h*) Under instructions from the Joint Director of Agriculture, the Agricultural Demonstrator of Bobbilli sent a sample of niger seed cake. This was analysed both for feeding and manurial value with the following results:—

Food value.	PER CENT.	Manurial value.	PER CENT.
Moisture ..	8·5	Nitrogen	5·23
Ash	7·7	Phosphoric acid (P_2O_5.	2·6
Crude proteins ..	32·7	Potash (K_2O)	1·48
Ether extractives ..	10·0	Lime C_aO)	0·86
Crude fibre ..	10·4		
Carbohydrates by difference ..	27·1		
	100·0		

It is seen from the analysis that niger seed compares very favourably with other oil cakes used as as cattle feed and as manures. It is reported that it is highly prized as a concentrate for milch cows.

(*i*) In order to use green-manure seeds which have lost their viability as manure, the manurial value of eight difference green manure seeds was determined and reported to the Director of Agriculture. Generally the seeds are kibbled and soaked before utilising them as manure.

(*j*) In connection with the fixing tarams of land six samples of soil were analysed for the Officer, Settlement Training, Madras.

(*k*) Malt extract prepared in the Government Malt Factory from a consignment of cholam purchased in Coimbatore was found to have bitter taste. An investigation started to trace the causes for this bitterness, revealed that it contained neither tannins nor peptones. Neither the cholam grains nor the malt extract were found to contain appreciable amounts of HCN. The polishings from green malt were, however, found to contain 550 parts per million of hydrocyanic acid. It appears as though the bitterness may be due to cyanophoric glucosides which are developed during germination. Polishing the green malt reduces the bitterness considerably.

(*l*) Three samples of sunnhemp plants manured and not manured with phosphatic fertilizers were examined for the Paddy Specialist. The manurial value of sunnhemp was not affected by fertilization with phosphates.

(*m*) In connection with scientific aid to the pepper industry and selection of site for Pepper Research Station, five soil samples taken from two sites on the West Coast were examined. The soils of the Peringam area were found to contain higher amounts of organic matter and nitrogen and the area was reported as suitable for locating the Station.

(*n*) One sample of concentrated yeast extract which was condemned as unfit for human consumption received from the Collector of Madras under advice from the Director of Civil Supplies, Board of Revenue, Madras, was analysed for manurial value. It was dark brown in colour and viscous like malt extract. It analysed 3·4 per cent N, 2·1 per cent P_2O_5 ; and 5·6 per cent K_2O and was recommended as suitable for use as manure.

(*o*) In connection with irrigation projects in Mathurai and Tiruchirappalli districts four samples of soils and one of water were analysed. The soils contained low amounts of water soluble-salts, the total solid content of the water was low and the conditions such as texture of the soil, drainage, etc., were reported as favourable.

(*p*) Following samples of interest sent by the Government Lecturing and Systematic Botanist, Lecturer in Agriculture, Oil

Seeds Specialist and Lecturer in Agricultural Economics were analysed for food values: (1) Prosopis Juliflora; (2) mesocarp powder of Parkia biglandlulose; (3) sweet potato hay; (4) flowers of Bassia; (5) Kapok seeds and (6) Kapok cake.

	Prosopis Juliflora.	Mesocarp powder of of Parika biglandlulose.	Sweet potato hay.
	(1)	(2)	(3)
	PER CENT.	PER CENT.	PER CENT.
Moisture	9·35	8·90	6·40
Ash	4·29	5·63	16·18
Crude protein	9·95	6·81	9·08
Ether extractives	0·81	1·87	5·42
Crude fibre	26·48	5·78	26·06
Carbohydrates	49·12	71·01	36·86
	100·00	100·00	100·00
Lime (C_2O)	0·36	0·89	3·70
Phsophoric acid (P_2O_5)	0·40	0·34	0·51
Sugars	..	16·0	—
Starch	..	25·0	..

	Flowers of Bassia.	Kapok seed.	Kapok cake.
	(4)	(5)	(6)
	PER CENT.	PER CENT.	PER CENT.
Moisture	10·44	7·37	9·06
Ash	4·23	5·16	5·81
Crude protein	4·63	24·88	27·56
Ether extractives	0·46	23·26	12·72
Crude fibre	2·43	14·85	13·03
Carbohydrates	77·81	24·48	31·82
	100·00	100·00	100·00
Lime	0·17	0·58	0·58
Phosphoric acid (P_2O_5)	0·38	1·92	2·20
Sugars	70·0	..	—
Starch	..	..	..

(*q*) In connexion with the selection of suitable site for fruit Farm in the South Kanara district twelve samples of soils collected from three sites, in Kadiri, Kavur and Moolky were analysed. Kavur site was recommended as more suitable than the other two sites.

(*r*) A sample of nut which looked like ivory palm nut (*phyteleiphas*) sent by the Divisional Industrial Engineer, Coimbatore, analysed 10·74 per cent oil, 15·34 per cent protein, 39 per

per cent carbohydrates, 0·50 per cent each of phosphoric acid and lime and 0·70 per cent potash. As it is reported that this palm contains an alkaloid-phytelephantin, it was suggested that it was not safe to use it as cattle food.

(*s*) Fourteen samples of oils from transformers in the Pykara Distribution System were tested for acidity and the results communicated to the Electricity Department.

(*t*) In connexion with the study of salt resistant flora of the West Coast 21 samples of water taken by the Government Lecturing and Systematic Botanist, Coimbatore, from different parts of the backwater areas of Nileshwar were analysed for total solids, chloride contents and pH.

(*u*) To encourage ryots to make greater use of the composts prepared in municipal areas in connection with the Grow More Food Campaign composts prepared from city wastes were analysed during this year also for several municipalities. The samples were generally found to be of average quality.

(*v*) Compost samples prepared out of night soil and out of farm wastes in connection with yield trials at the different agricultural Research Stations were also analysed and reported on.

(*w*) Twelve samples of waters, and 359 grains and straws were analysed in connection with fundamental research on paddy carried out by the Paddy Specialist.

(*x*) A sample of coffee husk ash sent by the Hunsur Works, Hunsur, was found to have remarkably high potash content of 46 per cent. No sample of similiar material analysed previously has given such high results.

(*y*) Sixty-five samples of foodstuffs seized under rationing offences and sent to us for examination by Police Courts, Rationing authorities and Magistrates were disposed off during the year.

(*z*) The assistance of the section was sought for by the Civil Supplies Department in determining the suitability of food and other grains for human consumption from time to time The samples analysed include 82 samples of fumigated milo and other sereals and 10 samples of foodgrains damaged by sea water.

(z^1) Seven samples of straight fertilizers and 27 manure mixtures were analysed in connection with the control of quality and price of manures as laid down in the Director of Agriculture's Circular No. G.1. 2754/44.

III. Research.

A. Soils.

Studies of the orgin and geo-chemistry of soils of the Madras Presidency.—A study of the profile characters, soluble salt contents chemical composition of clay fractions and geo-chemical aspects of soils of Madras which has been in progress for a number of years was continued during the year under report.

1. (*a*) *Coastal alluvium resembling black soils.*—Soil samples taken from a profile pit to represent coastal alluvium near Villipuram were examined. The sample contained more than 75 per cent of sand. The top soil was black in colour and the sub-soil was yellowish brown. The top soil on treatment with N/5 hydrochloric acid, washing and then treating with hydrogen peroxide became light yellowish brown, thus be having similar to other black cotton soils regarding colour. The sandy fractions of the soil examined under petrological microscope showed large amounts of quartz, microcline and other kaolinised felspars, pyroxenes and leucoxenes. Some of the quartz grains were rounded showing thereby the alluvial origin of the soil. The chemical analysis of the clay fraction showed that the top soil has 55·13 per cent of HCl in solubles 41·93 per cent of combined silica, and 6·45 per cent of HF residual, while the sub-soil gave 62·36 per cent, 34·98 per cent and 13·4 per cent of HCl insolubles combined silica and HF residue respectively. The combined SiO_2/Al_2O_3 molar ratio is practically the same for soil and sub-soil being 3·78 and 3·74 respectively. It is also seen that the colloidal fraction in both soil and sub-soil is same and the differences between the two being only in the colour which is due to humate and admixture of other minerals in the sandy fraction.

(*b*) *Geological associations of red soils in central districts.*—The following geological associations of red soils were noted in the course of investigations on red soils.

Near Saravanampatti (Coimbatore-Satyamangalam road) quartz haematite rocks were found to give rise to red soils.

In the vicinity of Hosur acidic, grey, weathered gniesses were responsible for the formation of red soils. Highly sandy and gravelly red soils of very deep red colour occurring round about Penugonda have had their origin from granites with pinkish felspars. In Hindupur in Anantapur district the red soils are brownish in colour and occur associated with kankar, showing that occurrence of kankar is not confined to black soils only.

2. *Study of South Indian soils in relation to their colour and physical and chemical properties.*—The above study which was initiated last year was continued during the year under report and twelve soil samples were examined for colour, texture, mineralogical composition chemical constitution as revealed by the use of different extractants during chemical analysis, and the base exchange properties. The soil samples examined include laterites from the West Coast, red soils from Tirunelveli district, black soils of Siruguppa and a few alluvial and brown soil of these localities.

Clay fractions were used in most of the investigations.

Colour.—The colour of the clay fractions, with its three important attributes of value hue and purity was determined in a relative manner by comparison with strips of known colour standards.

General constitution of clay was studied by a rough fractionation of the clay minerals into reactive and resistant groups, after extraction with hot 2 N. HCl and after treatment with hot concentrated acid. The chemical composition of the material dissolved out by the two extractants was studied and a general idea of the composition obtained.

The study of the chemical constitution was facilitated by expressing the amounts of the various chemical constituents on the basis of molar proportions and by calculating a number of ratios between the molar proportions of individual constituents or their group. Base exchange properties of the clays were determined ; and their mineral components of the coarse fractions were studied to identify and estimate the amounts of minerals present. The examination of physical properties was confined to the determination of the amounts of coarse fractions only.

Conclusions.—It was observed that N/5 HCl or H_2SO_4 did not extract an appreciable amount of the iron responsible for the colour of red soils. Hot 5 N acids extracted almost all the iron present, as shown by "the small difference between the amount of iron extracts by these acids and the amount extracted by hot con. HCl. The iron responsible for colour was removed by hot HCl of about a concentration of 2N. the remaining iron being removed by acid of higher concentration. On an average, from 90—95 per cent of the total iron was found to be responsible for the colour. It is obvious that the remaining iron is not present in the oxide form.

The relationship previously observed to exist between the colour of the clay and the molar ratio of the mono and Divalent bases to the iron oxide, or to the source of the remaining clay constituents was found to hold good for the clay samples examined during the year. A general correlation was observed between the total exchangeable base value and the colour of the clay, high values (about 100 M.l. per cent) being associated with black soils, medium one (about 60) with alluvial soils and low values (about 25) with red soils. A similar general correlation was traced between the specific gravity of the clay and the colour, high values, such as 2·6 being found amongst red soil, medium ones of the order of 2·4, in the case of alluvial soils and low figures like 2·2 with reference to black soils. Clays from laterite soils were found to be exceptions to these generalizations.

The mineralogical examination of the fine sand fraction revealed the presence of felspar of the microcline type in the case of red soils, and their general absence in alluvial and black soils.

3. *Investigation of the "Cholam effect and the changes in the the physico-chemical properties of the black cotton soil brought about by various crop rotations—New rotation experiments.*—These experiments were laid out at the Agricultural Research Station, Koilpatti, to find out the cause of the harmful effect of Irungu cholam on the cotton succeeding it in crop rotation. It had been noted in the "Tinnees tract" that cotton following cholam was invariably 16 per cent lower in yield than cotton following cereals. As no satisfactory explanation for this depressing effect of cholam was available, investigations were started in 1948–49 to study this problem.

During this year 228 samples from the experimental plots were analysed for the following (1) apparent specific gravity; (2) absolute specific gravity; (3) percentage of pore space; (4) water-holding capacity; (5) volume expansion; (6) total nitrogen; (7) organic matter, (8) pH; (9) conductivity; (10) mechanical composition consisting of clay, silt, fine and coarse sand; (11) base exchange properties consisting of exchange capacity, exchangeable Ca, Mg, Na and K.; (12) moisture in the air dry soil and (13) capillarity. These samples include those taken before and after the harvest of the cereal crop.

No definite conclusions could be drawn from the results obtained so far. However the older view that the harmful effect of cholam is due to rise of soda during its growth does not appear to be tenable. There is no increase in exchangeable sodium in the cholam plots as compared with that in the other cereal plots. In all cases the degree of alkalinization of the soil is very low and there is no increase of this factor at the end of the growing season of cholam.

4. *Reclamation of alkali lands in the Cauvery-Mettur Project area.*—A new centre was selected at Seethambalpuram to demonstrate the reclamation of vast areas of alkaline lands in the Cauvery-Mettur-Project area by utilizing gypsum, molasses and other corrections. The trials which were in progress since 1935 at Tandoni was abandoned as the results obtained were erratic. This centre is ideally situated and the owner of the land Sri P. S. Swaminatha Ayyar willingly placed the area for the experiments.

The treatments were randomized in four blocks A, B, C and D and each such block was parcelled into 20 plots of eight cents each. The treatments were planned to elicit information on the effect of individual ameliorants when applied alone and in combination. The preliminary analysis of the soil of the area indicated (i) the texture of soil was sandy loam with low percentage of finer fraction; (ii) the soil was poor in all essential plant food elements and (iii) the soil contained soda salts which increased with depth.

The degree of alkalinization in the area was very high though the soluble salt content of the soil was low (vide tables 1 and 2). The ameliorants were applied during the last week of September 1949, the plots were bunded to retain a fair depth of water and water let in and drained by percolation. After repeatedly draining for about fifteen times, a uniform basal dressing of 5,000 lb. of daincha was given to individual plots and a crop of paddy was raised. The crop suffered to a certain extent by the failure of the north east monsoon and prevalence of disease throughout the Cauvery-Mettur Project area. The statistical analysis of results of the experiments given in the statement indicate that grain and straw yield show the same trend and are in favour of molasses and green manure applied individually and in combination, namely molasses plus lime, gypsum plus green manure, and lime plus green manure. Gypsum by itself has not proved beneficial vide tables 3 and 4). The analyis of post-harvest soil samples is in progress.

5. *Reclamation of Palakarni swamp.*—This is a saline swamp 3,700 acres in extent belonging toMessrs. Amalgamations, Limited, and managed by Messrs. Simpson and Company situated six miles south of Saidapet.

A preliminary inspection and traverse of the area revealed that it is a tidal flat situated a few feet above the main sea level. More than 80 per cent of the area is composed of black to greenish black soil about six feet deep the highly brackish sub-soil water occurring about six feet below the surface. The soils are associated with gypsum indicating thereby that the soils are highly saline. Samples of soil taken from three pits showed that the salt contents of soil and sub-soil varied from 0·4 to 3·5 per cent. On the western edge (near Palakarni village road) where the texture of the soil was loamy the maximum salt concentration (1·62) per cent was at the surface (0–6″) and there was a gradual decrease of salt contents with depth. In the main area which comprises of more than 80 per cent of the total area the texture of soil is clayey. The salt contents in this area increased with depth, the 6—12″ depth soil was seen to contain one per cent salt while that at 12—24″ depth contained more than 3 per cent salt. It contained shells of gastropods and *lamella brancheates* at lower depth indicating the alluvial character of the soil. Some of the shells were very big lustrous and perfectly laminated and would have lead one to easily mistake them for micas. The black soils were found to crack very deeply at the surface. The soils are highly saline and can be reclaimed by.—

(*a*) washing out the salts below root zone by flooding the area with good water;

(*b*) providing proper drainage for the salt laden sub-soil water

The area at present is subject to inundation by brackish water of the Buckingham Canal during some parts of the year and until this is prevented by construction of suitable bunds or dykes it would not be possible to reclaim the land.

6. *Examination of alkaline lands near Idupalaypaya village in Rayachoti taluk, Cuddapah.*—The land belongs to Sri Sarangapani Gupta of Cuddapah. The land is irrigated with channel water from Papagni river which contains 45 parts per 100,000 of total solids comprising mainly of carbonates and bicarbonates of soda. The land which is situated at low level is subject to inundation from washings from higher reaches. The soluble salt content of the top soil is not very high (0·22 per cent) but is mainly composed of harmful salts like carbonate and bicarbonate of soda. As local conditions are not favourable for good drainage, it was not possible to recommend satisfactory reclamation measures.

7. *Soil studies in the Wynad tract in connection with citrus disease investigations.*—The studies which were initiated last year with the object of tracing the conditions responsible for the poor growth and high mortality of oranges in the area were continued during the year under report. The technical programme of chemical work was classified under two heads (A) Laboratory studies and (B) Field studies.

(A) *Laboratory Studies.*—Eighteen preliminary soil samples (pre-manure samples) collected at 1 foot intervals up to 3 feet depth from the six pits made in different regions of each of experimental plots at Odambam and Kottaram were analysed for chemical and mechanical analysis. The results of analysis are given in Tables 5 and 6. The following are tentative conclusions :—

(*a*) The soils from Odamba area are clayey and the finer fractions are more than 50 per cent in all the 3 feet layers of samples from the central as well as border regions. The percentage of (Fe_2O_3+Al_2O_3) are far higher than the other acid soluble mineral matter in all the samples ;

(*b*) The soils from the different regions, gradients and depths are deficient in lime, available P_2O_5 and K_2O. They are rich in nitrogen and total organic carbon but decrease with depth.

(*c*) The pH of the soils from all regions is acidic and practically constant —5·42 to 5·94.

With regard to soils at Kottaram—

(*a*) The general characteristics of the soils in this area are practically the same as in the case of bearing orchard ;

(*b*) the percentage of clay and other finer fractions are comparatively lower, particularly in the northern end of the experimental plot than in the soils of the bearing orchard ;

(*c*) the pH of the soil is more acidic than that of the bearing orchard.

During November 1949 post-manure samples were collected from the two plots—36 samples for each plot from 12 pits at

1 foot intervals, 2 pits representing each treatment—The analysis of the 36 samples from the experimental plot at Odambam has been completed and the results are given in table 7.

It would appear from the results that the treatments after the first year of trial have not made any effect on the physical and chemical properties of the soil of the plot. The available phosphoric acid and potash figures are very low while the lime in many cases shows a high figure which is due to the addition of the lime to the plot just before sampling by the owner of the garden inadvertently. The experiments were however continued.

The effects of liming can be judged from the results of analysis of samples collected in 1950.

The analysis of the samples collected from the pre-bearing orchard at Kottaram is in progress.

Soil moisture studies.—Estimation of soil moisture in the experimental orchards up to 4 feet depth at 1 foot intervals every month from November 1949 to March 1950 was conducted at the spot by the horticultural assistant attached to the Wynaad Colonization Farm.

The purpose of this study was to ascertain the extent to which soil moisture would be retained during the dry months following the south-west monsoon season as no irrigation facility exists in this area. The efficiency of the different methods for the conservation of moisture were studied.

Bearing orchard (Odambam).—The experimental plot was given a *mammatty* digging after application of lime though it was not included in the programme. This operation has disturbed the mulching and destroyed the cover crop and hence any conclusion drawn regarding the soil moisture variation during the dry period is bound to be erratic. The moisture figures for the coming year will be of some value since the error due to this digging will be eliminated.

Pre-bearing orchard (Kottaram).—Comparing the moisture figures obtained for the four depths in the treatments 'mulching' and 'cover crop' with those obtained for control (vide table No. 8) it appears mulching alone is effective to preserve the soil moisture. Soil moisture figures for March for the treatment cover crop is lower than the corresponding figures for control, presumably, cover crop itself taking up moisture for its growth and thus depleting the soil of moisture.

Shade crop has not grown sufficiently, being only about 2 years old to afford any shade to the surface of the soil and hence can be effective only in due course.

(B) *Field studies.*—Work contemplated under this head was not taken up during the year under review.

8. *Soil survey of tidal wave inundated area in Circars.*—Within a span of four years, an unusual tidal wave caused by the 1949

cyclone for a second time inundated practically the same area of about 100 miles long, 4 to 8 miles broad to a depth of 4 to 8 feet along the coast extending from Pithapuram to Bhimavaram in the East and West Godavari districts. The worst affected taluk was Amalapuram. Forty-four per cent of the total affected area lay within the taluk. An overall damage of thirty-one per cent was caused to paddy crop. Other taluks that were affected in the order of severity of damage were Razole, Narasapuram, Bhimavaram, Kakinada and Pithapuram taluks. The standing paddy crop which was in flowering or shot blade stage was damaged considerably as a result of the crop being submerged under water from 4 to 10 days. The yield from the crops was almost negligible. The straw was rendered unfit for use as cattle feed.

Sixty-six soil samples representing first and second foot, collected from the cyclone affected area were analysed for alkalinity and the data are presented in table No. 9. The values for total solids of samples of soil collected in the same villages during 1945 and 1949 cyclone are presented in table No. 10, for purposes of comparison.

In most of the cases the soils were rendered more saline during 1949 cyclone than in 1945.

Suitable methods of reclamation of saline soils by flooding and leaching were recommended.

9. *pH fluctuations in paddy soils.*—This work was conducted at the Paddy Breeding Station, Coimbatore with the object of determining the optium pH for the growth of paddy crop. Attention was confined to only 12 out of the 36 treatments under Maximum Potentialities experiment in the M. Block. The experiment included a set of 48 fallow plots as well. pH determinations were made twice every month throughout the growth period of the crop. Commencing from 29th August 1949 to 17th February 1950, 12 rounds of sampling were done. Table No. 11 shows the treatments and the mean values of the four replications of both the fallow and the cropped series.

It has to be borne in mind that the season was dry for a considerable portion of the experimental period and hence channel water was added to bring the soil samples to the required consistency more frequently than was done during the year 1948–49.

Nitrogen determinations were also made but as only three rounds have been completed it has not been included in this report.

The following conclusions can be drawn from the data presented :—

The differences in pH between treatments are in the order of 0·04 pH units. It can therefore be stated that differences are not pronounced.

The fluctuations in pH in the cropped area varies from 7·75 to 8·00 during the crop growth while the same variations in the uncropped area range between 7·65 to 8·12.

In summing up it may be stated that the seasonal fluctuations in soil pH are more pronounced than fluctuations due to treatments. These seasonal fluctuations in soil pH correspond with definite periods of crop growth. And the differences between the uncropped and cropped is particularly marked from the first week of October to the first week of January, the period of active growth of the crop.

The narrowing down of the range is entirely due to the effects of the crop and not due to any other cause. Hence the original finding that the pH fluctuations of a soil are modified by the growing crop is further re-affirmed (vide table No. 11).

10 *Soil survey of Lower Bhavani Project ayacut area.*—A survey of the Lower Bhavani Project ayacut area was undertaken for a period of one month. The survey of the area was more in the nature of an economic enquiry and as such no soil or other samples were taken for analysis. The services of Sri P. Narayanan Nair, District Agricultural Officer, Ootacamund, who had been intimately connected with this area as a special Demonstrator of the Lower Bhavani Project from 1933 to 1937 were placed at my disposal by Government at my request. During the enquiry the human material, their cattle, the crops now grown in the area, the soils and the river water were all examined systematically. Several recommendations were made, bearing on the general improvement of agriculture of the area. More important amongst them are given below :—

(*a*) Improvement in rearing and breeding the Bargur and the Madheswaranmalai types of cattle ;

(*b*) Anti-malarial measures to be instituted with the advent of irrigations ;

(*c*) Intense propaganda to be launched advocating growing of green manure with phosphate application as per T.V.A. plan. The phosphate may have to be subsidised ;

(*d*) A District Agricultural Officer and three senior Agricultural Demonstrators to be appointed for one year when the dry lands are changed over to dry irrigation. They may be given a roving commission with general instructions to help the ryots in all possible ways during the transition period ; and

(*e*) An Agricultural Research Station be established in the area with the primary objective of studying land utilization and selecting the crops best suited for the locality even if they do not happen to be food crops.

11. *Irrigation experiments on the black cotton soils of the Tungabhadra Project, conducted at the Agricultural Research Station, Siruguppa.*—After closure of the chemical laboratory at Siruguppa, the soils drawn from the various experimental plots at

Siruguppa are analysed by the Chemical Assistant (borne under the budget head of Irrigation, Navigation and Embankment Research) working at Coimbatore.

During the year, 476 samples were analysed. The details of the experiment and the conclusion drawn are given briefly below :—

(*a*) *Experiment on the effect of light irrigation on the movement of water soluble salts.*—This fundamental experiment was started in 1939 in block III field (1) of the Station and is intended to study the effect of continued light irrigations of different types such as Ryots' method, 2″ once in fifteen days, 3″ once in fifteen days and 3′ once in thirty days along with a No irrigation treatment. Soil samples are drawn once a year in summer. One hundred and sixty seven samples were drawn for the years 1948–49 and 1949–50. They were analysed for total solids and alkalinity. The summary of results are given in tables 12 to 14. The results indicate no evil effect of the different light irrigations, on the land

(*b*) *Studies conducted on the effect of heavy irrigation on the black soils.*—Heavy irrigation experiments of the black soils under different wet land cropping systems such as the single crop paddy, sugarcane-paddy rotation and double crop are being conducted in block V of the Station since the year 1939 to study the movement of salts.

During the year 1950 samples were analysed for total solids and chlorides. Out of the 24 samples drawn for the year 1949–50, 12 were analysed for physico-chemical properties also, such as base exchange, mechanical composition, etc. The summary of results are given in tables 15 to 24. The results do not indicate any increase in the salt content due to heavy irrigation.

(*c*) *Investigations on the movement of salts in soils under a four-course rotation of garden land crops, namely, cotton, wheat or korra, jonna and groundnut.*—These are new investigations started this year and are conducted in block VIII of the Station. Soil samples are drawn once a year after harvest of crops and analysed for salt content. The results given in Table 25 indicate that in soils under all the four crops the first foot contains less of salts than the second and third foot. The second foot soil shows less of salts than the third foot in all the treatments except cotton where the second and third foot show almost the same concentration of salts.

(*d*) *Analysis of waters drawn from the river Thungabadra and Siruguppa channel.*—Every month eight samples of water drawn from the above sources at different spots and depths were analysed for their silt content. The results given in table 26 indicate no marked difference between the river and channel water. The silt content was at its maximum in June-July when the south-west monsoon was more severe and minimum in May, i.e., summer.

B. Manuring and plant nutrition.

Permanent manurial experiments.—These trials have been continued with different crop rotations for the study of the effect of continuous cropping on soil manured with cattle manure and artificials supplying nitrogen, phosphoric acid and potash singly and in combination in the same manner year after year.

The old permanent manurials had the eightieth crop peria manjal cholam raised under rainfed conditions. Sowing was done on 17th July 1949 and harvesting on 18th December 1949. Owing to prevalence of extreme drought conditions the crop growth was poor and resulted in meagre yield of grain and straw. The yield data are presented in the table below :—

Plot No.	Treatment.	Acre yield of	
		Grain.	Straw.
		Lb.	Lb.
1	No manure	24	688
2	Nitrogen	77	1,448
3	N plus K	136	1,946
4	N plus P	219	3,200
5	N plus K plus P	101	2,394
6	K plus P	61	1,690
7	K	12	1,069
8	P	6	780
9	Cattle manure	17	912
10	Cattle manure residual	49	1,206

It was not possible to arrive at any conclusions due to abnormality of the season this year.

In the new permanent manurials, the fortieth crop, ragi was transplanted on 5th July 1949 and harvested in two stages on 27th September 1949 and 11th October 1949. The yield data are given below :—

	Eastern Series. Acre yield in lb.		Treatment.	Western Series. Acre yield in lb.	
	Grain.	Straw.		Grain.	Straw.
1	600	1,148	No manure	430	500
2	338	328	N	320	422
3	390	830	N plus K	314	390
4	846	1,406	N plus P	690	642
5	784	1,044	N plus K plus P	724	813
6	678	932	K plus P	818	786
7	488	810	K	574	680
8	712	750	P	614	698
9	826	1,042	Cattle manure	756	903
10	314	462	Cattle manure residual	482	560

The yield data show that the basal dressing of cattle manure has not benefitted the crop. The plots which received phosphate

application gave generally higher yield than the non-phosphate plots. Cattle manure has not proved definitely superior to N plus P plus K, N plus P or K plus P. P by itself has shown an increase in yield of grain and straw over 'No manure.' From the statistical analysis of yields of the past eleven crops of ragi raised in N.P.M. following conclusions were drawn :—

(*a*) Application of phosphates have improved grain yields in both the series over "no phosphate" plots.

(*b*) A complete manure (N + P + K) and cattle manure are the two highest regarding grain yields in both the series.

2. *Comparative efficiencey of commonly used green manure crops.*—The experiments reported last year to test the relative merits of common green manure crops, namely, dhaincha, sunnhemp, pillipesara and cowpea in A and D Blocks of wet lands, Central Farm, Coimbatore, were continued during the year. As usual the experimental plots in 'D' Block received a basal dressing of ordinary superphosphate, at 200 lb. per acre applied by placement method behind a country plough. The experiments were conducted to throw light on the following :—

(*a*) Green weight, dry weight, decomposability, leaf to stem ratio and the nitrogen content of the green manures ;

(*b*) effect in increasing paddy yields ; and

(*c*) effect on the nitrogen content and fertility status of the soils. The relevant data are presented in Tables 27 to 32 and remarks are confined to certain salient features which are mentioned below :—

(*a*) *Green weight, dry matter, etc., of green manure crops*—*A. Block.*—The yields of green matter by all the four green manure crops were higher than those obtained last year.

D. Block.—Dhaincha alone gave lower yield than last year. The yield of long duration variety sunnhemp sown this year was double that of last year. The following conclusions were drawn after subjecting the data to statistical analysis :—

A. Block.—Sunnhemp, Dhaincha, Pillipesara and Cowpea.

D. Block.—Sunnhemp, Dhaincha, Pillipesara and Cowpea.

In both the blocks the order of efficacy of these four green manure crops were the same. (Tables 27 and 28.)

Dry matter.—With regard to yield of dry matter it followed the same trend as the green matter.

Total nitrogen content.—Even though the yield in green matter was higher this year than that obtained last year, the total nitrogen content of green manure crops raised in A Block with the exception of pillipesara, was lower than that of last year. The total nitrogen content of the crops in D Block was higher than last year except in the case of dhaincha (*vide* Tables 29 and 30).

(*b*) *Manurial value on paddy.*—The yields of paddy grain and straw, variety G.E.B. 24 from 'A' and 'D' Block experiments are given in Tables 31 and 32, respectively. The results were statistically significant in both the blocks.

The conclusions are as follows :—

'A' Block experiment—

Grain.—Pillipesara, Cowpea, Dhaincha, Sunnhemp, Control

Straw—Pillipesara, Cowpea, Dhaincha, Sunnhemp, Control

Percentage increase in yield over control.

Treatment.	'A' Block Expt.		'D' Block Expt.	
	Grain.	Straw.	Grain.	Straw.
Dhaincha	68·1	190·8	47·0	77·1
Pillipesara	97·4	136·8	42·0	74·9
Sunnhemp	68·1	85·5	38·6	72·4
Cowpea	75·4	120·0	40·5	56·4
Control	(1,779	2,000	2,519	3,096)

yield in lb. per acre.

Both the monsoon failed this year and the scarcity for water was keenly felt. The succulent green manures increased yield more than the woody varieties. Pillipesara gave the maximum yield in both grain and straw. Cowpea was second in rank, whereas dhaincha and sunnhemp were third and fourth respectively.

The increase in grain yield due to green manuring was 68 to 97 per cent over the control whereas for straw it was 86 to 137 per cent.

'D' Block experiment.—

Grain—Dhaincha, Pillipesara, Cowpea, Sunnhemp, Control.

Straw—Dhaincha Pillipesara, Sunnhemp, Cowpea, Control.

Dhaincha gave the maximum yield of both grain and straw but statistically all the green manures were on par.

The percentage increase in yield of grain and straw due to green manuring were 37 to 47 and 56 to 77 respectively. The effect of green manure was more pronounced in the yield of straw than in grain showing thereby its influence more on the vegetative growth than on the productive phase.

Studies on green manuring of paddy.—Pot and field experiments were conducted this year on the same scale as in previous years, with some improvements. The main improvement was the development of better technique for the drainage in the pot culture experiments.

Pot culture experiments—Series I.—In this series a nitrogen starved soil from K plus P plot in the Old Permanent Manurials was used.

The treatments were—

I. No manure—Cropped and uncropped.
II. Green manure at 5,000 lb./acre. Cropped and uncropped.
III. Ammonium sulphate—N as in that Treatment II Cropped and uncropped.
IV. Green manure at 10,000 lb. per acre.
V. Ammonium sulphate—N as that in Treatment IV.
VI. Combination of green manure and ammonium sulphate Treatments II plus III.

GEB 24. Pure strain seedlings were used in the study. Pillipesara was used as the green manure and analysed to 0·43 per cent nitrogen on the wet basis while the ammonium sulphate manure contained 20·25 per cent nitrogen. Each treatment was repeated four times. Drainage water was collected from the pots every fortnight, till irrigation was stopped prior to harvesting, and was analysed for total, ammoniacal, nitrate and nitrite nitrogen, PH and oxygen absorption.

Observations—(*a*) *Drainage water*.—The results for ammoniacal and total nitrogen are summarised in Table No. 33. Nitrate and nitrite nitrogen were absent. The results confirm the findings of previous years viz., (1) only a small fraction of the total nitrogen content of the drainage water exit as ammoniacal nitrogen; (2) nitrate and nitrite nitrogen are absent and (3) soluble nitrogenous compounds other than ammoniacal, nitrate and nitrite nitrogen, play an important role on the nutrition of the paddy plant.

The results of pot-culture experiments (O.P.M. field —K plus P plot soil).—Five rounds of drainage water were collected and analysed for pH value, oxygen absorption for 3 minutes cold and 30' (minutes) hot besides total nitrogen and ammoniacal nitrogen. The samples were also tested for nitrites and nitrates and found to be absent. The paddy plants manured with green manure suffered from wilt disease, hence their yield was very low. The results of analysis for pH value and oxygen absorption are presented in Table No. 34 and the yield data in Table No. 35.

The oxygen demand of the drainage water was high during the second and the last round. It was comparatively low in the third and fourth rounds, when the plant was actively growing. These observations were same as those of last year.

The pH value of the drainage water tends to increase and is slightly alkaline in the second and third rounds. Then there is a slight fall especially in the last round (5th). These results confirm last year's observations.

The yield of paddy in the pot culture experiments show that ammonium sulphate (double dose) gave the highest yield of both grain and straw. Combination of ammonium sulphate and green manure (Pillipesara) single dose each was second in rank but far behind the ammonium sulphate (double dose). Ammonium sulphate single dose closely followed the combination. Both

green manure single and double dose gave yields poorer han the 'n manure' treatment. The plants manured with green manure were more severely attacked by wilt disease than these of amm - nium sulphate series.

The pot-culture experiments 'D' Block soil).—The drainage water was not drawn during the growing period of the crop. The GEB. 24 variety was grown on the same day as the field experiment. The plants, especially those of green manure series, were attacked by wilt disease. The data are given in Table 36.

The green manure single dose gave the best results; yet only a very slight increase over control. Other treatments gave lesser values than no manure. The plants were attacked by wilt disease.

(*b The nitrogen balance.*—The soil, sand, manure, etc., used at the start of the pot experiments were analysed for the nitrogen content. The total amount of nitrogen supplied was balanced against the nitrogen recovered in the drainage water residual soil and plant material. The results are presented in Table 37. This table discloses the fact that while in the uncropped pots there is a loss of nitrogen, there is no such loss in the cropped pots. On the other hand there is a positive gain in nitrogen content. Just how and wherefrom the paddy plant obtains and builds up this additional quota of nitrogen is still obscure and require investigation. The data available do not admit of the views held by Harrisson and Subramanyam Iyer that green manure nitrogen is lost as gaseous nitrogen but the indications are that the nitrogen is used up by the paddy plant and is of direct manurial value. This is evident from the results of Treatments IV and VI where green manure was used singly and in combination. These treatments show a definite and positive nitrogen balance, though green manure single dose (Treatment II) shows a minus balance and hence loss of nitrogen. But this treatment was badly affected by a fungus disease which generally attacked the plants in this study during the early stages of their growth and cannot be considered as normal. Treatments IV and VI did suffer only to a very limited extent.

Pot-culture experiment—Series II.—In this series a typical paddy soil from 'D' Block, Wetlands was used, under the same treatments and replications, etc., as in Series I, with the omission of collecting and analysing drainage water. In fact the irrigation water was not allowed to drain, so that nitrogen is lost in the drainage water. It was proposed to work out the nitrogen balance in this series also after harvest and analysis of the residual soil and plant material.

Pot-culture experiment—Series III.—This is a new experiment started this year.

It is believed that green manure and other organic manures, in contrast to mineral fertilizers, improve also crop quality. It was proposed to study crop quality by studying the granular make

up of pure starches from the grain and the feeding value of the grains themselves in addition to the feeding and manurial value of the straw.

A poor quality rice Co. 13 was grown in pots on a nitrogen starved soil under the following treatments :—

I. No manure.
II. Green manure at 5,000 lb. per acre.
III. Ammonium sulphate per cent N= that in II.

Each treatment was repeated eleven times.

Pure starches were prepared from the grain obtained from the three treatments. Five hundred starch grain each from Treatments I and II were measured with a view to work out the size differences and the granular make up. The size measurements of starch from Treatment III is in progress.

Field experiments.—This was repeated on the same scale as in previous years in 'D' Block Wetlands, the treatments being the same as in pot culture experiments I and II, the uncropped treatments being omitted. Each treatment was repeated five times in randomized blocks measuring 1·25 cents each.

Green manure decomposition studies.—The yield of paddy in the field experiment 'D' Block are given in Table No. 38.

The combination of single dose of green manure and ammonium sulphate each gave the highest yield of both grain and straw. The next best treatment was green manure double dose (10,000 lb. per acre). Ammonium sulphate double dose was third in rank. and ammonium sulphate single dose was fourth. Due to Fusariun attack, the single dose green manure treatment gave a lower yield of both grain and straw than the 'no manure' series.

(4) *Green leaf manures*—(*a*) *Nitrogen content.*—Nitrogen content of leaves and stems of some of the green leaf manures commonly used in this State were estimated and it is given in Table No. 39. Datura leaves were found to be the richest of all green leaf manures analysed last year and this year.

(*b*) *Decomposability.*—The decomposability of the leaves and stems of the eleven species of green leaf manures was determined and the values presented in Table 40.

Leaves.—Calotropis was found to decompose most readily whereas Gliricidia leaves were next best. Pungam, Cassia auriculata, Thevitia come next in rank. Cassia siamea, croton sparciflorus. Delonix and Poovarasu is the next group in descending order of decomposab lity. The last group was Datura and Sesbania.

Stems.—Gliricidia topped the list, which was closely followed by calotropis, croton sparciflorus, and pungam. Thevitia and Cassia auriculata were far inferior to the above mentioned leaf manures. Datura, Sesbania, Delonix and Cassia siamea come under a third group. Poovarasu was the last to decompose.

Even though Datura leaves contained more nitrogen than other green leaf manures, their decomposability was relatively poor.

(c) *Nitrifiability.*—The nitrifiability of the leaves of s sbanea speciosa was found to be 34·73 per cent within four weeks of incubation.

(5) *Reduction of manurial bills for potatoes.—Experiment at the Agricultural Research Station, Nanjanad.*—The object of the experiment was to explore the possibilities of reducing the dosage of manure now advocated for potatoes in the Nilgiris without impairing the efficiency of yields or the productive capacity of the soils.

The experimental scheme is as below :—

1 No lime (Series)
2 Lime at 2 tons per acre (series).
3 Nanjanad mixture (Control) 2 : 5 : 3
4 Reduction of 2N to N keeping P and K constant.
5 Reduction of P to 3, 1 and O keeping N and K constant.
6 Application of 60 lb. of P_2O_5 to lupin preceding potato.

The experimental plots were laid out in field No. 14 A and the three plots of field No. 1. The soil, a light red loam, was analysed prior to the application of manures.

Average values of top foot of soil.

	Available. Per cent.	Total. Per cent.
Nitrogen	..	0·167
Phosphoric acid (P_2O_5)	0·0126	0·190
Potash (K_2O)	0·0096	0·526
Lime (CaO)	..	0·114
pH	..	5·52
Organic carbon	..	1 77

In the first year of trials one crop of potato was planted on the 11th and 12th April 1949 and harvested on the 16th, 17th and 18th of August 1949 in the first series.

The results of yield are given in Table 41. It is clear from the data presented that the average yield of 7,745 lb. of potatoes per acre with 1N plus 0P plus 3K and no lime, had risen to 15,250 lb. per acre with increased dosage of manuring of 1N plus 5P plus 3K and 2 tons of lime. The average yield with double dose of nitrogen and 5P plus 3K with no addition of lime was only 15,240 lb. per acre. So it is clear that by suitably adjusting the different proportion of the nitrogen and phosphoric acid and keeping potash constant, the average yield of potatoes can be raised to the neighbourhood of 15,000 lb.

The following could be inferred from the crop yields in the first year of trials when the figures were analysed statistically (vide Table 42) :—

(1) The yield due to liming was not significant.

(2) Double dose of nitrogen was superior to single dose of nitrogen.

(3) The yield due to phosphoric acid was significant. 5P gave the highest yield. Next in rank was 3P, 1P and 0P. However there was no significant difference between 5P and 3P.

(4) Significance to other interactions was nil.

When the economics of the yield data (vide Table 43) is considered 2N plus 5P plus 3K gave the highest margin of profit of Rs. 1,347-2-4 without liming. But the next best return of profit and very near the above was obtained from 1N plus 5P plus 3K and with the addition of lime, namely, Rs. 1,301-11-1.

No positive conclusion can be drawn at this stage as the experiment is in the first year of trial.

Soil analysis --Post harvest samples—Top soils.—Out of the 128 post harvest samples (top soil) the analysis for the different constituents of 96 samples have been completed so far and their average values according to the respective treatments are presented in Table 44.

From the results of analysis the following tentative inferences can be drawn:—

(1) There is a general increase in the soil nitrogen after the harvest of the potato crop. This nitrogen would benefit the succeeding cereal crop in the rotation.

(2) There is no great difference in the total phosphoric acid content in the different treatments of the post-harvest samples. There is, however, a slight increase in the available phosphoric acid in general and the total phosphoric acid in the un-limed series.

(3) There is a definite increase in the lime content in the limed plots and no variation from the original value in the unlimed plots.

(4) There is a slight increase in the pH after cropping both in the limed and unlimed series.

(5) A general increase in organic carbon is noticed which would indicate that the organic matter content had increased.

(6) No variation in nitrogen, phosphoric acid or pH is discernable due to single or double doses of nitrogen application.

The above conclusions are only tentative. Further analytical work is in progress. A second crop of potato was planted on 31st March 1950 in the second series. This crop had the benefit of 60 lb. of phosphoric acid applied to a preceding crop of lupin which was ploughed in. The lupin crop did not come up well owing to drought.

(6) *Compost experiments.*—The experiments on night soil compost compared with farmyard manure and no manure as control were continued at the four Agricultural Research Stations at Coimbatore, Tirurkuppam, Anakapalle and Samalkota. At Lam Farm, Guntur, the experiments could not be started due to the non-availability of compost at the proper time.

(i) *Central Farm, Coimbatore.*—The yields of ragi grain from the compost plots of Field Nos. 68 and 74 were lower than the same from the no-manure plots. Though the compost plots of Field No. 74 gave higher yields of cholam grain and straw over the control, the yields were not statistically significant. In the case of paddy (Co. 14) there were only small differences in yield of grain and straw between the control and manured plots, which were again not statistically significant. While the yield of sugarcane (Co. 419) of compost plots was 27 per cent more than the control, the difference was not significant statistically.

The plots in Field Nos. 68 and 74 were sown with cholam (Co. 9) on 17th March 1950 and 23rd March 1950 respectively. The stand of the crop is satisfactory. In wet lands K. block, after paddy, sugarcane (Co. 419) was planted on 22nd April 1950 after the application of compost and farmyard manure to supply one-third of 250 lb. nitrogen per acre. Sprouting was found to be satisfactory but there was a severe borer attack.

(ii) *Rice Research Station, Tirurkuppam.*—In the experiments with single-crop paddy (Co. 19) the grain and straw yields of compost and farmyard manure plots were significantly higher than no manure.

Owing to the lack of supply of composting materials from the municipality, town refuse and night soil were composted in two pits only in February-March 1950. Composted materials showed, when examined, that the decomposition was not complete.

(iii) *Sugarcane Research Station, Anakapalle.*—Though the sugarcane crop (Co. 419) was damaged to some extent due to floods in October 1949, the compost and farmyard manure plots gave slightly increased yields over control but the increases were not statistically significant. The paddy (B.A.M. 3) crop was submerged for two days during the floods of October 1949 and yet the compost and farmyard manure plots gave higher yields than the control though not significant.

The compost pits, when examined, showed that the decomposition was not complete since some undecomposed leaves were seen in the material.

(iv) *Agricultural Research Station, Samalkota.*—In the experiments with compost and farmyard manure against no manure on paddy, the manured plots gave lower yields than the control. The crop was severely hit by the cyclone in October 1949 and suffered from want of water at the flowering stage. Hence the yield data were not statistically analysed. The experiments with plantains started in January 1949 had to be discarded because of the heavy and uneven damage caused to the crop by the cyclone.

Paddy (SLO. 12) was planted on 20th February 1950. In spite of the crop being affected by Schoenobius in the initial stages

it had come up well and was harvested on 12th May 1950. The compost plots gave 8 per cent higher yield than the control while the farmyard manure plots gave 15 per cent higher yield.

The planting of plantain was completed by 25th February 1950 and one-third of the dose of compost and farmyard manure applied on 7th March 1950. The crop has established itself well and is progressing satisfactorily.

Experiments with farm waste compost and farmyard manure against no manure were conducted at the Agricultural Research Stations at Palur, Adutural, Pattambi and Maruter.

I. *Agricultural Research Station, Palur.*—The compost plots gave significantly higher yields of sugarcane (Co. 449) than the control while the farmyard manure plots yielded the highest. In the case of the cumbu crop the grain yield of the compost plots was lower than the control but was not significant. Though the straw yield from the compost plots was 7 per cent more than that of the control, the difference was not statistically significant. The yields of ragi grain (R. 382) from the manured plots were higher than the control but were not significant while straw yields from the farmyard manure and compost plots were statistically higher than those of the control by 11 per cent and 7·5 per cent respectively.

The groundnut crop in the second area is not yet harvested and the crop appears to be satisfactory.

The plots of the third area were given the preparatory *manatti* digging prior to the planting of ragi.

II. *Agricultural Research Station, Adutural.*—Trials with compost and farmyard manure against no manure were conducted in three sets of plots on paddy. The yield of grain kuruvai (ADT. 3) from compost plots was only 2 per cent higher than control but not significant. In the case of kuruvai thaladi, no significant differences in grain yields between the manured and control were obtained. In the experiments with Co. 25 paddy, grain yields of manured plots were lower than no manure. While for kuruvai and thaladi manured the farmyard manure plots yielded slightly less than the other plots. But the differences were, however, not significant. Trials with samba main single crop (Co. 25) indicated that the grain yields of cattle manure and compost were 2·2 per cent and 1·3 per cent higher than no manure though not significant.

III. *Agricultural Research Station, Pattambi.*—In the experiments conducted with Modan paddy, though the compost and farmyard manure treatments gave 20 per cent higher grain yields the differences in yield were not statistically significant.

The experimental plots were ploughed and weeds removed after the receipt of rains in the last week of May. But due to continuous rains, manuring and sowings could not be done.

IV. *Agricultural Research Station, Maruteru.*—The compost experimental plots were planted with MTU. 5 variety of paddy. The crop was adversely affected and lodged by the cyclone of October 1949. The yields of grain of the compost and farmyard manure plots were the same but lower than the control. Farmyard manure yielded 3 per cent more of straw than no manure. But the results of the experiments were not statistically significant.

The experimental plots were laid out in the second crop season of 1949–50 and compost and farmyard manure applied to the respective plots on 3rd February 1950. MTU. 15 was planted on 4th February 1950 and the seedlings had established themselves well and the stand was good in all the replicated plots. The crop was harvested on 5th May 1950. Farmyard manure gave the highest yield of grain followed by compost while no manure yielded the least. The grain yields alone were statistically significant.

The experiment will be repeated in the main crop season in single and double-crop areas with MTU. 5 paddy.

In general, at most of the Agricultural Research Stations the crop yields of compost plots have not been statistically higher than no manure though in some cases they have been lower. It may be expected, however, that the performance of compost would be better in the second year of the experiments.

7. *Studies on foliar diagnosis.*—This work which aims at the study of relationship of yields to nutrition of crop plants grown in differently fertilized plots as indicated by periodical analysis of the leaves of the same physiological or metabolic age was continued this year with ragi crop raised in the New Permanent Manurials. Fifty leaf samples were collected for examination. The analysis of leaf samples are in progress.

8. *Improvement of marginal lands.* — To improve the fertility level of the extensive areas of marginal and sub-marginal lands avaliable in our Province a simple method has been tried at four centres in Tirunelveli district. The method consists in (*a*) applying 30 to 45 lb. of phosphoric acid in the form of superphosphate ; (*b*) raising a suitable leguminous fodder crop in the land after inoculating the seed with the specific culture ; (*c*) ploughing in the green manure crop if the growth is not vigorous or cutting the first flush of the crop for fodder if growth is good and subsequently ploughing in the second flush and (*d*) raising a grain or cash crop after the legume has been incorporated into the soil.

The centres selected for the study were Agricultural Research Station, Koilpatti, Tirunelveli, Ambasamudram and Nanguneri. On account of the failure of the north-east monsoon the legume made very poor growth in the last three places mentioned and no grain crop could be raised. In the Agricultural Research Station, Koilpatti, the first crop of legume did not make a good growth. So after ploughing in the green matter, a crop of pillipesara was

raised during the north-east monsoon. About 12,000 lb. of green matter obtained in this way were ploughed in. Its effect will be studied on succeeding crop of cumbu which is proposed to be raised during this season.

To improve marginal lands under irrigation a piece of unproductive land in Eruvadi estate belonging to Messrs T. V. Sundaram Iyengar & Sons was selected. The dose of application on P_2O_5 was raised to 60 lb. of P_2O_5 per acre and daincha was grown with seeds inoculated with the specific bacteria. After ploughing in the standing crop of daincha at flowering stage, a grain crop either paddy or ragi is proposed to be raised in the plot.

C. *Plant physiology.*

Sri T. R. Narayanan was in charge of the plant physiology work. The work reported below is on the basis of an approved programme submitted to the Research Council in 1946.

(*a*) *Pre-soaking studies.*—These experiments were started in February 1949 with paddy, groundnut and cowpea in pot cultures to see how far growth and yields could be improved in these crops by adopting the pre-soaking technique described by Roach and Roberts. The results are summarized in Tables 45 to 52 and and the general indications are given below :—

Paddy.—By soaking paddy seed in a 20 per cent solution of tribasic potassium phosphate, the grain yield was found to be increased by nearly 40 per cent over the control. A 10 per cent solution of the same salt gave a smaller increase of 21 per cent in grain yield. The improvement in straw yields was not significant. Other forms of potassium phosphate, namely, the mono and the dibasic salts did not show any appreciable effect on grain or straw yields.

A parallel trial carried out in the field at the paddy-breeding station gave a result with 13 per cent increase in grain yield from 20 per cent tribasic phosphate solution and 10 per cent increase with 10 per cent phosphate.

Groundnut.—The best solution for this crop appears to be monopotassium phosphate at 2 per cent or 5 per cent strengths. Higher concentrations seem to affect the germination adversely. With a 2 per cent solution, there was an increase of 83·5 per cent in pod weight over the control, while it was 109 per cent with 5 per cent KH_2PO_4 (vide Table 47).

Ragi (*Tables* 48 *and* 49).—In the first trial, it was found that pre-soaking ragi seed in a 20 per cent solution of tripotassium phosphate gave a significant increase of 116·8 per cent in grain and 48·3 per cent in straw. The same solution used at a weaker concentration of 10 per cent gave 20·7 increase over the control in grain and 17·1 per cent increase in straw neither of which was

significant. In a second experiment, the increase in grain was 10·4 per cent and 29·1 per cent in straw, as a result of soaking in 20 per cent tripotassium phosphate solution.

Bengalgram.—Preliminary trials made both in pots and in the field have indicated that presoaking in 5 per cent KH_2PO_4, 2 per cent KH_2PO_4 and 2 per cent $CaHPO_4$ solutions would be useful in giving increased pod yields.

Cowpea.—For this crop, calcium phosphate, dipotassium and tripotassium phosphate were all found helpful in increasing the yield of pods while for—

Blackgram, none of the phosphates tried were beneficial. In this case it is necessary to test the effect of salts other than potassium or calcium phosphates.

(*b*) *Pre-treatment with growth hormones—Potato.*—In order to test the effect of pre-treating potato tubers in different growth-regulating substances and see how far the growth or yields could be improved thereby, as claimed by certain workers, like Zika (1939), Walcher and Zika (1942) and Alban (1945), an experiment was started at the Agricultural Research Station, Nanjanad, in September 1949 using the variety Great Scot, under different strengths of indole acetic acid and indole butyric acid. The results are given in Table 53 and it will be seen that both the hormones are capable of increasing tuber yields by 16 or 17 per cent when used at a concentration of 60 parts per million. With indole butyric acid, a higher concentration of 100 parts per million increased the yield by 33 per cent, but a similiar concentration of indole acetic acid was found to depress the yield. In view of the promising results, a second trail has been laid out on the same lines at Nanjanad in April 1950 on the main crop. The results from this experiment are not yet available.

Paddy.—Pre-Soaking in a growth harmone-beta-indole acetic acid, also increased the grain yield, though to a lesser degree than by tribasic potassium phosphate.

(*c*) *Vernalisation.*—The results of vernalisation studies carried out on seven paddy varieties since 1946 are summarised in Table 54. The following conclusions can be drawn from the data.

Plant height is more often improved than reduced by vernalisation, but this increase is not on the whole very marked. In AKP.8., vernalisation for twenty-two days reduced plant height by nearly 20 per cent.

In tillering, two varieties GEB. 24 and AKP. 8 show a definite improvement after vernalisation. It is not so marked in AKP, 5, except under L. 14 treatment.

The three short duration varieties Adt. 3, PTB. 10 and Co. 21 and MTU. 7 did not show any improvement in tillering by vernalisation, and in PTB. 10 in particular the tillering was uniformly depressed by vernalisation treatments.

In flowering except in AKP. 8, under twenty-two days of darky-day treatment, where the flowering was hastened by nearly 20 per cent, flowering in other varieties was not hastened by more than 7 per cent by any of the treatments tried.

Grain yield.—Three varieties, namely, GEB. 24, AKP. 5 and AKP. 8, were definitely responsive to vernalization treatments in grain yield, the mean increase ranging from 12 to 38 per cent. Three short-duration varieties, Adt. 3, PTB. 10 and Co. 21 were not so responsive, except Adt. 3 under fourteen days of continuous light, treatment, MTU. 7 was another variety that did not show any definite improvement in grain yield as a result of vernalisation.

Straw yield.—The general trend in straw yield was similiar to grain yield responses, though less marked. Here also, GEB. 24 and AKP. 8 showed consistant increase over control under different vernalisation treatments. In AKP. 5, the straw yield tended to be reduced by vernalisation, though the grain yield was improved MTU 7 and the three short duration varieties Adt. 3, PTB. 10 and Co. 21 were not responsive to vernalisation, in point of straw yields.

It is suggested that the responsive varieties could be tried on a larger scale in different rice-growing centres, in order to assess the possibilities of utlising this method of seed pre-treatment as a means of improving yields in rice.

(*d*) *Effect of trace elements*—(i) *Paddy.*—The result of three seasons trials in H Block of the Central Farm wet lands, on the effect of spraying dilute solutions of copper zinc and manganese sulphates on paddy yields are summarised in Table 55 as percentages of the unsprayed control of each year.

It would be seen from the table that an increase of 10 to 15 per cent is obtained in grain yield, as a result of spraying the young crop with suitable dilutions of copper, zinc and manganese sulphates singly or in combination. The effect on straw yield is similar but less pronounced.

(ii) *Sweet potatoes.*—An experiment was laid out in Field No. 61 to test for the third year in succession, the effect of supplying different doses of borax on sweet potato yields and the results are presented in Table 56. It will be seen that a 40 lb. dose has increased tuber yields consistently for three years, although the increase in the present season 1949 was not high enough to reach statistical significance.

(iii) *Lucerne.*—A similiar experiment has been in progress on lucerne, to test the effect of different doses of borax on the growth and yields. Here too 40 lb. of borax per acre appears to improve the yields (vide Table 57) but further trials are necessary before any reliable conculsions can be drawn.

D. Bacteriology.

Sri M. Sanyasi Raju was in charge of Bacteriological section throughout the year. Eight hundred and eighty-eight samples were analysed during the year under report. A statement of the nature of samples analysed is given in Table 58.

1. *Soil Microbiology—Black soils—Agricultural Research Station, Siruguppa.*—The microbiological analysis of the black soils, Agricultural Research Station, Siruguppa were carried out for the last 9 years after the advent of the irrigation. The experiment was concluded this year. The microbial population increased enormously during first two years after the commencement of irrigation then they got stabilised and remained constant after a decrease. They were always above the pre-irrigation level. Garden land cultivation gave the maximum results and no manure was least. Fallow and heavy irrigation treatments were intermediate.

The microbial activity followed the same trend as the microbial population. The hunger for easily available energy material like dextrose was most in the no manure plots and least in the garden land soil (vide table No. 59).

2. *Legume studies*—(*a*) *Associated growth of legumes and cereals.*—The experiment on the associated growth of pulses e.g. redgram, blackgram, greengram and lab lab, in different proportions with cholam was continued both at Vizianagram and Dharmapuri sub-stations of the Pulses Specialist. Ordinary superphosphate was applied like last year at the rate of 200 lb. per acre.

Due to failure of monsoon, the crops suffered in both the places. The crops were stunted in growth at Dharmapuri, with the result, it had to be abandoned. The crops at the Vizianagram sub-station were harvested and yield data are given in table No. 60 and the analysis of soils in table No. 61. The analysis of the produce are not yet completed.

The combination of ½ pulse and ½ cholam gave the maximum return in the redgram, lab lab and greengram series, but in the case of blackgram series, ¼ pulse and ¾ cholam gave the highest yield of both grain and straw of cholam and of grain and bhusa of pulses are taken together.

The nitrogen content of the soil due to the growth of pulse crop was increased with an increase in the ratio of pulses in greengram and blackgram series. It was very little in redgram series and practically nil in lab lab series.

(*b*) *Green manure studies.*—Reported under green manure studies under section B. Manuring and Plant Nutrition.

(*c*) *Green manure decomposition studies.*—Reported under section B. Manuring and Plant Nutrition.

(*d*) *Green leaf manures.*—Reported under section B. Manuring and Plant Nurition.

(*e*) *Isolation of legume cultures.*—Various legume cultures were isolated from different Agricultural Research Stations suitable to some of the commonly grown legumes in the State.

(*f*) *Supply of legume cultures.*—The list of legume culture supplied to the various Agricultural Research Stations and private individuals is given in table No. 62. One hundred and eighty-one cultures were supplied during the year.

3. *Training.*—Reported under teaching.

E. Agro-Industries.

1. *Indian Council of Agricultural Research Scheme of Research on Palmyrah—Report for the period 19th April to 28th May* 1950.—In May 1949 the Indian Council of Agricultural Research sanctioned a scheme of three years duration for carrying out investigations on Chemical and Technological aspects of the utilization of palmyrah juice with existing plantations at Palamcottah in Tirunelveli district.

Sri D. V. Krishna Rao, Assistant Agricultural Chemist, appointed for the scheme took charge on 19th April 1950 at Coimbatore, the temporary headquarters of the scheme and completed the preliminary work connected with the collection of literature on previous scientific studies carried out on palmyrah in India and Ceylon, during the period under report.

Due to postponement of the scheme of research on palmyrah to December 1950 the scheme work was discontinued from 28th May 1950.

2. *Study of antoxitdants.*—The effect of antioxidants used in the preparation of jaggery on its keeping quality was studied. The antioxidant used was the one prepared from extracted seed-cake viz., groundnut cake. The method of extraction of the antioxidant was the one given in the Journal of the Society of Chemistry and Industry, 56, 237 (1937) using dilute acetic acid, methyl alcohol and acetone for the extrations. The antioxidant was a viscous brownish coloured substance.

Ordinary bazaar jaggery was reboiled with 0·25 gm. and 0·50 gm. of antioxidant for every three pounds of jaggery and without the addition of the same. The jaggeries thus obtained were stored in wide mouthed dry bottles with the mouth covered by clean white muslin cloth. They were analysed at monthly intervals for their chemical composition (glucose, sucrose and acidity) to see whether there was any improvement in their keeping quality due to the antioxidant. The samples of jaggery were exposed in a thin layer in a petri dish to an atmosphere of

75 per cent relative humidity in a desiccator and their moisture absorption at monthly intervals studied. The chemical composition and moisture absorption of the different jaggeries were not beneficially affected by the use of the antioxidant thereby indicating probably that the antioxygenic concentrate does not possess much effect on the keeping quality of the jaggery.

It was thought that if the antioxygenic concentrate were to be added to the sugarcane juice itself, probably it may have some effect on the keeping quality of the jaggery. Hence the antioxidant from the groundnut cake was added to the sugarcane juice itself in two proportions of 0·25 gm. and 0·50 gm. for every three pounds of jaggery (i. e., 25 lb. juice). They were stored as before in dry wide mouthed bottles covered with white clean muslin cloth. They were analysed for their chemical composition and moisture absorption at 75 per cent relative humidity at monthly intervals. The results indicated that the addition of the antioxygenic concentrate did not possess any beneficial effect on the keeping quality of jaggery with regard to their chemical composition and moisture absorption.

It is proposed to try some cereal flours as antioxidants in the preparation of jaggery and find out their effect on its keeping quality.

3. *Fungaldiastase—Aspergillus oryzae.*—With a view to reviving this item of work, studies made with the stock cultures showed that due to long storage there was deterioration in their diastatic activity. To make them regain their vigour several attempts were made to cultivate them in different media and increase their potency. But the attempts were not met with success. So cultures for further work will be obtained from the Indian Institute of Science, Bangalore, and the Indian Agricultural Research Institute, New Delhi.

F. Miscellaneous.

Storage trials with nitric chalk.—Under instructions from the Director of Agriculture, Madras, storage trial with nitric chalk was started on 23rd November 1949 to study its behaviour on storage conditions. Three bags were received from Messrs. N. S. Guzder, General Shipping and Forwarding Contractors, Bombay under instructions from the Director of Supplies, Bombay. One of the bags was received in a damaged condition.

The bags were stored and samples were drawn at monthly intervals for the following :—

(1) Determination of moisture content and physical conditions;

(2) Physical condition of manure.

(3) To record loss or gain in weight.

Relevant data are given in the table below :—

Date.	BAG No. 1		BAG No. 2		BAG No. 3	
	Wt. lb.	Moisture per cent.	Wt. lb.	Moisture per cent.	Wt. lb.	Moisture per cent.
23rd November 1949	114	13·70	117	12·85	117	15·70
23rd December 1949	115	14·20	118	13·53	117	15·39
23rd January 1950	116	14·84	119	13·87	116	14·89
23rd February 1950	116	15·77	119	14·24	111	11·05
23rd March 1950	114	14·30	119	13·62	103	13·72
23rd April 1950	111	15·00	116	15·54	95	15·02
23rd May 1950	108½	20·60	110½	22·07	87	18·58
23rd June 1950	105	23·28	105	27·26	81	17·14

The material was absorbing water during storage and ran into liquid with a consequent loss in weight.

Publications.—The following papers were submitted for publication during the year :—

1. A Simple Volumenometer—E. J. Verghese in J. Science Industrial Research, India, 1949. 8. B. 197–29.

2. Market Quality of rice—E. J. Verghese in J. Science Industrial Research, India, 1949, 8, 482–86.

3. A Standard Process for Cooking Rice for Experimental Purposes—E. J. Verghese, Madras Agricultural, Journal 1950. 37, 217–21.

4. A Note on Pre-soaking in Phosphate Solutions for increasing Yield in Rice by T. R. Narayanan and S. Gopalakrishnan—Madras Agricultural Journal, Volume XXXVI, No. 7, July 1949, pages 319–322.

5. Crop Planning for the Tungabhadra Project Ayacut by Dr. S. Kasinathan, Madras Agricultural Journal, Volume XXXVI, No. 10, October 1949, pages 465–469.

6. How the Chemistry Section helps the Farmer by P. D. Karunakar, Madras Agricultural Journal, Volume XXXVI, No. 12, December 1949, pages 549–551.

7. Some Lessons of the Bhagavadi Demonstration Farm by Dr. S. Kasinathan, Volume XXXVI, No. 2, February 1950, pages 50–54.

8. Vernalization as a Method of improving Yields on Rice by T. R. Narayanan and S. Gopalakrishnan, Volume XXXVII, No. 6, June 1950, pages 229–238.

Exhibition and Exhibits.—The section participated in the All-India Swadeshi and Industrial Exhibition held in Madras during December 1949 to January 1950. Exhibits were also sent in connexion with exhibitions of the same kind at various places held during fairs and festivals.

Visitors.—The following were some of the distinguished visitors to the section during the year :—

(1) His Excellency the Governor of Madras (The Maharaja of Bhavnagar) ;

(2) The Hon'ble the Premier, Sri P. S. Kumaraswami Raja ;

(3) The Hon'ble the Minister for Food and Agriculture, Sri A.B. Shetty ;

(4) Dr. J. S. Patel, Director of Agriculture, Bihar, Patna;

(5) Dr. Maurice Malye, Ex-minister of Agriculture, Indo-china ;

(6) The Hon'ble Sri T. Mariappa, Home Minister to the Government of Mysore ;

(7) Lieut.-Col. Diwan Bahadur Sir A. Lakshmanaswami Mudaliar, Vice-Chancellor, University of Madras ;

(8) Dr. Ignatief and Mr. Edward Shim, Fertilizer Experts of the F.A.O.

(9) D . S. Ramanujam, Director, Potato Research, Patna.

(10) Sri Valjekar, Honorary Bone Meal Adviser to Union Government.

(11) Sir T. S. Venkatramanan, C.I.E., Retired Sugarcane Expert, Government of India, Member of Expert Committee ;

(12) Dr. Cheema, Retired Fruit Adviser, Government of India, Member of Expert Committee.

(13) Dr. Luthra, Principal, Agricultural College, Benares Hindu University, Member of the Expert Committee.

Strength of staff as on 30th June 1950.—Particulars regarding the strength of staff, permanent and temporary, as on 30th June 1950 are given in table 63 as required in the Director of Agriculture's Circular No. X3. 1222/48, dated 24th January 1949.

ACKNOWLEDGMENT.

I have great pleasure in placing on record the unstinted and loyal co-operation of my officers and subordinate staff.

COIMBATORE,
4th August 1950.

P. D. KARUNAKAR,
Government Agricultural Chemist.

TABLE No. 1.—*Results of alkalinity determinations of soil samples from the alkali reclamation experimental plots at Seethambalpuram near Pattukottai in the Cauvery-Mettur Project area.*

Preliminary analysis.

Heads of analysis.	Block A.			Block B.			Block C.			Block D.		
	0–1′.	1′–2′.	2′–3′.	0–1′.	1′–2′.	2′–3′.	0–1′.	1′–2′.	2′–3′.	0–1′.	1′–2′.	2′–3′.
CO_3	Nil	Nil	Nil	Nil	0·0015	0·0015	Nil	Nil	Nil	0·006	0·0045	0·012
HCO_3	0·0244	0·0275	0·0824	0·021	0·032	0·052	0·018	0·032	0·034	0·095	0·079	0·104
Chlorine	0·011	0·018	0·014	0·0071	0·016	0·0177	0·011	0·012	0·0071	0·043	0·024	0·021
SO_4	0·0165	0·0169	0·0231	0·023	0·023	0·016	0·0087	0·007	0·0049	0·013	0·0045	0·011
Ca	0·003	0·0025	0·0025	0·0065	0·0035	0·0015	0·004	0·005	0·004	0·002	0·001	0·001
Mg	0·0028	0·0024	0·003	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Total solids (estimated)	0·069	0·130	0·161	0·059	0·10	0·140	0·045	0·045	0·050	0·174	0·133	0·173

Calculated salts.

$CaCO_3$	..	..	..	..	..	0·002	0·002	..	..	..	0·005	0·0025	0·0025
$Ca(HCO_3)_2$	0·012	0·010	0·010	0·026	0·012	0·004	0·016	0·020	0·016	..	..	..	..
$Mg(HCO_3)_2$	0·017	0·014	0·018	..	..	..	..	..	..	0·131	0·109	0·143	
$NaHCO_3$	0·0018	0·011	0·082	0·0014	0·032	0·067	0·008	0·022	0·030	0·005	0·0035	0·017	
Na_2CO_3	..	..	..	..	..	..	..	..	..	0·071	0·040	0·035	
NaCl	0·018	0·030	0·023	0·012	0·026	0·029	0·018	0·020	0·012	0·019	0·0070	0·016	
Na_2SO_4	0·024	0·025	0·034	0·034	0·034	0·024	0·013	0·010	0·0072				
Total	0·0728	0·090	0·167	0·073	0·1056	0·126	0·055	0·072	0·0752	0·2313	0·1620	0·2135	

Mechanical analysis.

Moisture	0·64	2·10	2·34	0·35	0·96	2·80	0·36	1·62	3·17	1·77	1·46	2·10
Clay	6·34	16·87	21·17	1·41	9·51	20·26	3·82	14·64	27·93	17·98	13·88	20·77
Silt	1·80	2·35	2·51	4·78	1·17	4·11	0·75	2·15	3·71	2·54	0·77	2·40
Fine sand	15·66	11·71	10·77	14·01	11·08	8·23	14·03	7·59	13·27	10·26	8·65	9·60
Coarse sand	75·16	68·08	65·31	79·73	77·98	67·44	81·12	75·21	54·95	67·54	76·67	66·48
Acid solubles	1·04	0·99	0·24	0·07	0·26	..	0·28	0·41	0·14	1·68	0·03	0·75
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

TABLE NO. 2.—*Results of complete chemical analysis of the preliminary soil samples from the alkaline reclamation trial plots, Seethambalpuram, Pattukottai and Cauvery-Mettur Project area—Expressed as percentages on dry basis.*

Heads of analysis.	Block A.			Block B.			Block C.			Block D.		
	0–1′.	1′–2′.	2′–3′.	0–1′.	1′–2′.	2′–3′.	0–1′.	1′–2′.	2′–3′.	0–1′.	1′–2′.	2′–3′.
Moisture	0·64	2·10	2·34	0·35	0·96	2·81	0·36	1·62	3·17	1·77	1·46	2·10
Ignition loss	0·64	1·27	1·59	0·55	0·91	1·23	0·44	1·28	2·23	1·73	1·34	1·85
HCl insolubles	96·63	91·96	97·44	97·77	95·03	91·16	97·86	93·56	88·86	90·40	92·81	88·55
HCl solubles (by difference)	2·73	6·77	7·97	1·68	4·06	7·61	1·70	5·16	8·91	7·87	5·85	9·60
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
$Fe_2O_3 + Al_2O_3$	2·47	6·09	7·27	1·59	3·83	7·00	1·46	4·63	7·90	6·43	5·15	7·90
Fe_2O_3	1·21	1·74	2·25	0·80	1·31	1·96	0·90	1·63	1·96	1·93	1·62	2·35
Al_2O_3	1·26	4·35	5·02	0·79	2·52	5·04	0·56	3·00	5·94	4·50	3·53	5·55
Lime (CaO)	0·11	0·17	0·19	0·10	0·18	0·14	0·06	0·310	0·50	0·58	0·21	0·56
MgO	0·21	0·42	0·50	0·15	0·22	0·39	0·12	0·29	0·51	0·28	0·22	0·36
K_2O	0·10	0·18	0·18	0·05	0·10	0·20	0·10	0·14	0·30	0·20	0·17	0·21
Na_2O (by difference)	0·17	0·42	0·43	0·08	0·18	0·44	traces	0·04	0·25	0·30	0·13	0·28
P_2O_5	0·01	0·01	0·01	0·009	0·01	0·006	0·016	0·018	traces	0·02	0·02	0·02
SO_4	0·03	0·06	0·07	0·08	0·30	0·17	0·05	0·06	0·05	0·08	0·05	0·07
Carbon	0·099	0·041	0·051	0·153	0·078	0·056	0·102	0·072	0·048	0·169	0·055	0·090
Nitrogen	0·014	0·012	0·013	0·023	0·016	0·020	0·015	0·01	0·006	0·018	0·006	0·013
Availables.												
P_2O_5	0·001	0·0003	traces	0·0003	traces	traces	0·001	0·001	0·001	0·002	traces	0·002
K_2O	0·004	0·005	0·007	0·006	0·007	0·005	0·007	0·006	0·006	0·016	0·009	0·008
PH	8·10	8·65	8·87	7·74	8·41	8·60	7·77	8·50	8·55	8·90	8·84	8·87

TABLE No. 3.—*Alkaline soil reclamation experiments at Pattukottai, Cauvery-Mettur Project area.*

Transplanted on 26th October 1949. Variety Co. 25 Paddy. Treatments—20.
Harvested on 27th February 1950. Net area—0·8 cents. Replications—4.

Grain.

Particulars. (1)	Treatments. (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Grain yield per plot in pounds—												
A	0·00	2·75	4·63	2·63	3·75	0·00	3·75	3·75	4·50	2·13	2·25	1·38
B	0·00	0·13	0·50	5·75	9·13	0·88	0·88	1·25	7·13	2·50	4·13	8·00
C	0·25	1·75	0·13	2·13	2·50	0·75	0·00	0·88	2·13	0·75	1·13	0·00
D	0·75	0·13	3·25	5·13	1·13	0·38	1·63	2·00	0·75	1·13	2·25	0·50
2 Total	1·00	4·76	8·51	15·64	16·51	2·01	6·26	7·88	14·51	6·51	9·76	9·88
3 Average	0·25	1·19	2·13	3·91	4·13	0·50	1·56	1·97	3·63	1·63	2·44	2·47
4 Acre yield lb.	31·25	148·7	265·6	488·3	515·6	62·5	192·5	246·1	453·2	203·1	304·7	308·7
5 Yield as percentage on control ..	100·00	475·8	849·8	1,563·0	1,650	200·00	615·9	787·4	1,450	649·8	952·8	987·9

	Treatments—*cont.*								Standard error.	S.E. of the differences of means.	Critical differences at 1 per cent level.	Mean of average.
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
1 Grain yield per plot in pounds—												
A	0·75	3·38	3·25	2·38	1·75	6·13	3·38	4·38	..	..	..	2·85
B	4·13	5·88	8·38	5·38	8·63	5·25	5·88	8·38	..	..	..	4·61
C	0·13	0·00	3·13	0·00	0·38	4·50	1·38	0·00	..	..	..	1·30
D	1·38	2·38	0·13	0·25	4·75	6·88	1·13	5·13	..	..	..	2·05
2 Total	6·39	11·64	14·89	8·01	15·51	22·76	11·77	17·89	2·62	5·12	13·21	..

| | | |

TABLE NO. 4—*Straw.*

Particulars. (1)	Treatments. (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Straw yield per plot in pounds—												
A	0·38	5·25	9·00	8·50	10·00	1·13	9·00	8·50	9·50	4·75	5·75	2·50
B	0·38	1·75	2·50	10·50	16·00	4·00	3·25	3·75	12·75	6·75	9·50	14·50
C	1·00	4·38	2·00	6·00	9·00	3·75	0·00	1·50	5·55	2·50	5·00	60·0
D	2·50	4·75	6·25	9·50	4·25	2·25	5·50	5·75	3·00	3·00	6·50	2·25
Total	4·26	16·13	19·75	34·50	39·25	11·13	17·75	19·50	30·80	17·00	26·75	19·25
Average	1·06	4·03	4·94	8·62	9·81	2·78	4·44	4·87	7·70	4·25	6·69	4·81
Acre yield lb.	132·9	503·9	617·5	1,077	1,227	347·6	555	612	961·2	531·3	8·343	601·2
Yield as percentage on control	100·0	379·2	464·7	810·6	923·4	261·6	417·7	461·0	723·3	399·7	627·9	492·4

Particulars. (1)	Treatments—*cont.* (14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Standard error. (22)	S.E. of the differences of means. (23)	Critical differences at 1 per cent level. (24)	Mean of average. (25)
Straw yield per plot in pounds—												
A	2·00	7·00	9·00	7·00	7·50	16·75	7·00	11·25	..	..	..	7·09
B	11·25	11·00	11·75	8·75	14·50	11·75	10·25	19·75	..	..	..	9·23
C	2·50	0·13	6·50	0·00	3·25	10·25	4·75	0·00	..	..	..	3·40
D	4·00	6·00	0·38	1·25	8·00	11·75	5·00	9·25	..	..	..	5·06
Total	19·75	24·13	27·63	17·00	33·25	50·50	27·00	40·25	..	..	..	..
Average	4·94	6·03	6·91	4·25	8·31	12·62	6·75	10·06	6·37	9·00	23·24	..
Acre yield lb.	617·5	753·9	863·2	531·3	1,039·0	1,579·0	843·7	1,257·0	199·0	..	726·25	..
Yield as percentage on control	464·7	567·2	649·2	399·7	781·6	1,188·0	643·9	945·8	..	..	..	..

Conclusion.—Ranking at 1 per cent level 18 20 5 4 17 9 15 19 11 14 3 13 8 12 7 16 10 2 6 1

TABLE NO. 5.—*Results of chemical and mechanical analysis of preliminary soil samples from the bearing orchard at Odambam, Kalpetta and Wynaad—Results expressed as percentages on dry basis.*

Heads of analysis.	Border regions.						Central regions.		
	Tree No. 16.			Tree No. 4.			Tree No. 74.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Moisture	2·21	2·09	2·01	2·46	2·39	2·22	2·32	2·15	2·11
Ignition loss	11·43	10·39	10·48	12·43	10·64	10·76	9·66	9·12	8·29
HCl. insolubles	59·74	59·33	57·08	54·17	50·69	51·75	61·72	62·62	64·97
Solubles	28·83	30·28	32·44	33·40	38·67	37·49	28·62	28·26	26·74
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
$Fe_2O_3 + Al_2O_3$	27·80	29·28	31·48	33·09	37·10	36·39	27·51	27·75	26·64
Fe_2O_3	11·70	11·84	11·80	12·91	14·56	15·60	11·14	10·90	10·65
Al_2O_3	16·10	17·44	19·68	20·18	22·54	20·79	16·37	16·85	15·99
CaO	0·107	0·060	0·064	0·146	0·069	0·064	0·059	0·029	0·029
MgO	0·157	0·195	0·231	0·151	0·070	0·123	0·022	0·150	0·050
K_2O	0·170	0·136	0·206	0·180	0·156	0·146	0·177	0·159	0·151
Na_2O	0·510	0·394	0·435	0·207	0·643	0·450	0·049	Traces.	0·096
P_2O_5	0·120	0·078	0·089	0·139	0·115	0·078	0·129	0·101	0·086
Nitrogen	0·163	0·105	0·081	0·185	0·103	0·062	0·117	0·085	0·065
Carbon	1·257	0·923	0·892	1·590	1·005	0·732	1·856	0·847	0·629
Availables—									
P_2O_5	0·0011	Traces.	Traces.	0·0014	0·0001	0·0001	0·0015	0·0008	0·0006
K_2O	0·0098	0·0067	0·0067	0·0075	0·0071	0·0074	0·0059	0·0032	0·0028
Mechanical analysis.									
Clay	41·65	45·14	45·81	46·28	49·59	48·56	38·49	39·19	37·46
Silt	8·37	10·12	11·91	17·43	17·09	18·84	15·47	14·23	12·36
Fine sand	16·11	15·14	10·39	9·82	10·89	12·63	19·92	17·02	17·74
Coarse sand	24·33	25·28	27·73	20·52	15·73	15·19	24·43	26·43	28·14
Soln. loss	9·54	4·32	4·16	5·95	6·70	4·78	1·69	3·13	4·30
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
pH ..	5·62	5·55	5·65	5·68	5·79	5·89	5·94	5·77	5·91

Heads of analysis.	Central regions—*cont.*			Border regions.					
	Tree No. 63.			Tree No. 114.			Tree No. 105.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Moisture	2·48	2·56	2·83	2·69	2·50	2·24	3·09	2·69	2·59
Ignition loss	9·80	9·96	9·48	12·61	9·42	11·45	13·46	12·45	11·75
HCl. Insolubles	61·67	59·85	56·96	51·41	51·01	49·48	56·10	55·67	54·11
Solubles	28·53	30·19	33·56	35·98	39·57	39·07	30·44	31·88	34·14
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
$Fe_2O_3+Al_2O_3$	26·92	29·64	32·20	34·27	39·21	38·69	29·31	30·83	33·36
Fe_2O_3	10·23	11·11	11·82	14·44	13·39	15·72	10·80	11·23	11·98
Al_2O_3	16·69	18·53	20·38	19·83	25·82	22·97	18·51	19·60	21·38
CaO	0·089	0·058	0·066	0·089	0·054	0·049	0·132	0·039	0·064
MgO	0·091	0·101	0·163	0·192	0·076	Traces.	0·305	0·098	Traces.
K_2O	0·178	0·221	0·207	0·128	0·213	0·063	0·144	0·193	0·139
Na_2O	0·039	0·143	Traces.	0·163	Traces.	0·328	Traces.	0·073	0·473
P_2O_5	0·119	0·095	0·092	0·113	0·093	0·094	0·125	0·112	0·097
Nitrogen	0·150	0·101	0·068	0·163	0·108	0·079	0·220	0·146	0·098
Carbon	1·101	0·970	0·716	1·552	1·420	0·958	2·320	1·120	1·268
Availables—									
P_2O_5	0·0015	0·0006	0·0006	0·0013	0·0070	Traces.	0·0017	0·0009	0·0005
K_2O	0·0062	0·0028	0·0034	0·0057	0·0058	0·0054	0·0092	0·0074	0·0097
Mechanical analysis.									
Clay	40·00	47·41	50·56	51·28	45·73	45·54	48·23	48·39	51·88
Silt	11·62	12·11	13·26	17·56	22·24	24·28	12·53	15·57	15·54
Fine sand	17·08	15·25	14·47	11·83	10·06	9·83	11·94	10·69	10·29
Coarse sand	27·16	22·71	15·33	15·95	15·57	13·86	20·26	19·20	16·89
Soln. loss	4·14	2·56	6·38	3·38	6·40	6·49	7·04	6·15	5·40
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
pH	5·67	5·80	5·67	5·58	5·45	5·61	5·52	5·76	5·42

TABLE No. 6.—*Results of chemical and mechanical analysis of preliminary soil samples from the pre-bearing orchard at Kottaram, Kalpetta and Wynaad (expressed as percentages on dry basis).*

Heads of analysis.	Border regions.						Central regions.		
	Tree No. 2.			Tree No. 9.			Tree No. 57.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Moisture	2·03	2·53	2·90	2·63	2·75	2·77	2·49	2·65	2·71
Ignition loss	7·41	9·09	8·55	9·52	9·53	9·37	8·07	7·95	7·69
Insolubles	68·96	64·48	62·22	68·47	62·40	63·03	73·41	69·02	67·59
Solubles	28·63	26·43	29·23	22·01	28·07	27·60	18·52	23·03	24·72
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
R_2O_3	23·16	25·82	27·84	21·48	27·02	26·74	18·02	22·17	23·84
Fe_2O_3	7·82	8·31	9·28	6·98	8·22	8·23	6·61	7·41	7·68
Al_2O_3	15·34	17·51	18·56	14·50	18·80	18·51	11·41	14·76	16·16
CaO	0·197	0·122	0·217	0·122	0·086	0·093	0·065	0·072	0·072
MgO	0·021	0·175	0·025	0·249	0·193	0·260	0·140	0·192	0·215
K_2O	0·269	0·292	0·348	0·227	0·301	0·259	0·321	0·390	0·450
Na_2O	0·301	0·725	0·354	0·500	0·320	0·796	Traces.	Traces.	Traces.
P_2O_5	0·115	0·114	0·068	0·117	0·092	0·103	0·115	0·115	0·102
Nitrogen	0·106	0·078	0·059	0·156	0·110	0·094	0·140	0·095	0·073
Carbon	1·060	0·701	0·359	2·040	0·939	1·130	1·433	0·824	0·453
Availables—									
P_2O_5	0·0012	0·0007	0·0007	0·0024	0·0029	0·0014	0·0013	0·0008	0·0005
K_2O	0·0055	0·0050	0·0069	0·0056	0·0054	0·0038	0·0100	0·0064	0·0043
Mechanical analysis.									
Clay	42·00	48·14	50·40	35·36	58·53	55·29	37·17	46·18	48·09
Silt	5·53	7·11	7·46	11·91	1·64	3·28	5·53	5·33	7·25
Fine sand	20·15	17·54	18·55	22·26	18·44	18·77	21·14	20·02	19·84
Coarse sand	28·45	23·22	21·83	26·71	20·61	21·43	32·49	26·51	24·27
Soln. loss	3·74	3·99	1·76	3·76	0·78	1·23	3·67	1·96	0·55
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
pH	4·2	4·5	4·6	4·5	4·4	4·3	4·3	4·1	4·8

Heads of analysis.	Central regions—*cont.*			Border regions.					
	Tree No. 63.			Tree No. 104.			Tree No. 115.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Moisture	2·15	2·38	2·39	1·82	2·29	2·39	1·93	2·17	2·38
Ignition loss	7·43	7·54	6·86	5·65	6·61	6·65	5·72	5·54	5·59
Insolubles	74·03	69·49	69·63	81·91	75·75	72·31	81·28	78·23	77·19
Solubles	18·54	22·97	23·51	12·44	17·64	21·04	13·00	16·23	17·22
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
R_2O_3	18·01	22·09	22·98	12·25	17·00	21·01	12·40	14·95	16·20
Fe_2O_3	5·91	7·30	7·53	4·39	5·63	6·25	3·77	4·60	4·91
Al_2O_3	12·10	14·79	15·45	7·86	11·37	14·76	8·63	10·35	11·29
CaO	0·051	0·079	0·058	0·093	0·108	0·144	0·100	0·064	0·072
MgO	0·590	0·233	0·144	0·085	0·021	0·144	0·231	0·298	0·299
K_2O	0·345	0·420	0·423	0·204	0·306	0·340	0·274	0·234	0·313
Na_2O	Traces.	0·039	0·050	0·016	0·314	0·112	0·462	0·737	0·473
P_2O	0·094	0·103	0·094	0·078	0·082	0·103	0·093	0·088	0·087
Nitrogen	0·120	0·085	0·085	0·102	0·072	0·053	0·112	0·078	0·068
Carbon	1·192	0·835	0·385	1·030	0·617	0·428	1·394	0·877	0·615
Availables—									
P_2O_5	0·001	0·0006	0·0004	0·0022	0·0011	0·0010	0·0029	0·0015	0·0008
K_2O	0·0064	0·0069	0·0062	0·0077	0·0091	0·0073	0·0062	0·0050	0·0050
Mechanical analysis.									
Clay	33·98	44·31	44·21	23·40	35·55	39·00	24·90	29·27	31·14
Silt	5·83	5·62	5·47	3·60	4·09	3·73	3·62	9·42	10·76
Fine sand	23·47	21·84	21·76	23·30	22·19	18·10	24·94	24·74	21·14
Coarse sand	34·80	27·56	28·17	44·38	35·01	36·83	42·37	35·84	35·78
Soln. loss	1·92	0·67	0·39	5·32	3·16	2·34	4·17	0·73	1·18
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
pH ..	4·4	4·5	4·7	5·58	5·3	5·2	4·3	4·3	4·4

TABLE No. 7.—*Results of analysis of soil samples (post manure) from the bearing orchard at Odambam, Kalpetta and Wynaad.*

Heads of analysis.	Tree No. 4.			Tree No. 16.			Tree No. 74.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Moisture	2·20	2·10	2·19	2·21	2·40	2·32	2·52	2·30	2·32
Ignition loss	11·20	10·45	9·34	9·26	9·67	9·58	9·37	9·03	7·99
HCl. Insolubles	54·09	51·88	51·59	61·16	56·69	55·62	61·23	61·74	65·42
Solubles	34·71	37·67	39·07	29·58	33·64	34·80	29·40	29·23	26·59
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
($Fe_2O_3+Al_2O_3$)	33·03	36·07	37·50	27·86	32·14	33·45	28·07	28·67	26·23
Fe_2O_3	12·90	14·92	15·36	12·32	13·04	12·57	12·04	11·09	11·65
Al_2O_3	20·13	21·15	22·14	15·54	19·10	20·88	16·03	17·58	14·58
CaO	0·09	0·09	0·08	0·127	0·070	0·080	0·101	0·094	0·074
MgO	0·17	0·09	0·14	0·162	0·20	0·24	0·050	0·163	0·072
K_2O	0·17	0·15	0·14	0·18	0·14	0·170	0·190	0·143	0·152
Na_2O	0·04	0·02	Traces.	0·07	0·02	Traces.	0·032	Traces.	0·020
P_2O_5	0·11	0·06	0·05	0·08	0·08	0·04	0·13	0·120	0·087
Nitrogen	0·170	0·10	0·09	0·190	0·14	0·07	0·12	0·08	0·04
Carbon	1·32	1·07	0·87	1·42	1·20	0·74	2·07	0·97	0·65
Availables—									
P_2O_5	0·001	Traces.	Traces.	0·0008	Traces.	Traces.	0·0012	0·0006	Traces.
K_2O	0·010	0·008	0·006	0·009	0·007	0·007	0·0070	0·0040	0·004
Mechanical analysis.									
Clay	47·19	49·22	48·46	42·51	46·56	46·34	39·56	39·04	37·61
Silt	19·89	19·65	19·65	14·31	15·44	14·65	15·29	15·30	14·52
Fine sand	10·35	7·76	10·37	11·44	9·77	8·24	12·63	13·11	14·32
Coarse sand	20·64	20·13	18·80	28·79	26·46	29·00	31·26	31·96	32·26
Soln. loss	1·93	3·24	2·12	2·95	1·77	1·77	1·26	0·59	1·29
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Heads of analysis.	Tree No. 68.			Tree No. 114.			Tree No. 105.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Moisture	2·50	2·62	2·50	3·97	2·75	2·39	3·16	2·91	2·78
Ignition loss	8·30	9·47	9·43	13·38	12·40	11·81	13·04	11·64	11·57
HCl. Insolubles	62·05	59·97	56·72	51·65	51·55	50·35	55·45	54·30	52·65
Solubles	29·65	30·56	33·85	34·97	36·05	37·84	31·51	34·06	34·78
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
$(Fe_2O_3+Al_2O_3)$	28·85	30·07	33·60	33·70	35·20	36·22	29·80	33·14	34·01
Fe_2O_3	10·97	11·24	12·60	14·70	14·26	15·80	10·72	12·00	12·73
Al_2O_3	17·88	18·83	21·00	19·00	20·94	20·42	19·08	21·14	21·28
CaO	0·151	0·110	0·110	0·130	0·116	0·074	0·101	0·074	0·074
MgO	0·107	0·124	0·174	0·162	0·107	Traces.	0·209	0·120	Traces.
K_2O	0·192	0·197	0·207	0·140	0·110	0·073	0·190	0·140	0·123
Na_2O	0·025	0·070	Traces.	0·130	0·127	Traces.	0·072	Traces.	Traces.
P_2O_5	0·120	0·086	0·090	0·125	0·090	0·112	0·142	0·064	0·087
Nitrogen	0·170	0·098	0·065	0·250	0·160	0·100	0·250	0·130	0·090
Carbon	1·92	0·98	0·76	1·970	1·430	1·000	2·220	1·170	1·030
Availables—									
P_2O_5	0·0014	0·0007	Traces.	0·001	0·0007	Traces.	0·001	0·0009	Traces.
K_2O	0·008	0·007	0·003	0·007	0·0070	0·006	0·009	0·0070	0·007
Mechanical analysis.									
Clay	40·18	47·32	48·86	45·00	45·39	46·97	45·82	51·44	52·82
Silt	12·23	12·33	14·09	19·37	19·95	22·39	16·88	15·33	16·34
Fine sand	12·23	11·31	11·73	8·82	10·82	11·28	9·46	9·43	9·11
Coarse sand	34·01	28·33	25·09	22·35	22·82	18·94	25·27	21·61	19·18
Soln. loss	1·35	0·71	0·23	4·46	1·02	0·42	2·57	2·19	2·55
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Heads of analysis.	Tree No. 45.			Tree No. 53.			Tree No. 26.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Moisture	2·16	2·02	2·00	2·23	2·00	2·00	4·07	2·00	1·97
Ignition loss	11·14	10·13	9·60	11·42	10·15	10·15	10·13	10·80	9·28
HCl. Insolubles	58·65	57·90	56·55	57·15	58·50	56·05	55·95	52·30	57·95
Solubles	30·21	31·97	33·85	31·43	31·35	33·80	33·92	36·90	32·77
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
$(Fe_2O_3+Al_2O_3)$	29·80	31·50	33·00	30·93	31·00	33·23	32·57	35·73	30·73
Fe_2O_3	12·23	13·92	14·00	12·69	13·02	14·73	13·27	15·34	15·00
Al_2O_3	17·57	17·58	19·00	18·24	17·98	18·50	19·20	20·39	15·73
CaO	0·127	0·127	0·090	0·180	0·140	0·090	0·180	0·060	0·090
MgO	0·087	0·070	0·120	0·070	0·123	0·076	0·070	0·060	0·060
K_2O	0·160	0·182	0·190	0·160	0·150	0·150	0·170	0·180	0·160
Na_2O	0·016	0·012	0·100	0·020	0·030	0·070	0·020	0·010	Traces.
P_2O_5	0·070	0·075	0·013	0·047	0·030	0·026	0·090	0·100	0·070
Nitrogen	0·230	0·180	0·100	0·270	0·130	0·090	0·162	0·100	0·090
Carbon	1·720	0·920	0·740	1·970	0·900	0·700	1·970	0·960	0·840
Availables—									
P_2O	0·0012	0·0010	Traces.	0·0010	0·0009	Traces.	0·0014	0·0009	Traces.
K_2O	0·0090	0·0100	0·0054	0·0090	0·0004	0·0064	0·0110	0·0090	0·0056

Mechanical analysis.

Clay	38·90	47·70	47·75	37·95	41·75	44·55	39·54	44·40	40·94
Silt	16·75	14·35	13·90	17·60	15·70	16·30	17·34	20·15	16·96
Fine sand	10·85	10·45	13·95	9·75	11·45	11·80	9·75	11·45	11·40
Coarse sand	29·80	26·65	24·40	29·60	28·55	25·35	27·85	23·30	28·70
Acid solubles	3·70	1·65	5·10	2·55	2·00	1·35	5·52	0·70	2·00
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Heads of analysis.	Tree No. 33.			Tree No. 35.			Tree No. 93.		
	0–1′.	1–2′.	2–3′.	0–1′.	1–2′.	2–3′.	0–1′	1–2′	2–3′.
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Moisture	2·20	2·28	1·96	2·20	2·02	2·12	2·00	2·23	2·14
Ignition loss	11·40	10·27	9·14	10·50	10·48	10·03	10·80	10·02	8·96
HCl. Insolubles	52·70	57·75	56·50	62·60	59·55	59·50	61·45	60·25	60·15
Solubles	35·90	31·98	34·36	26·90	29·97	30·47	27·85	30·73	30·89
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
($Fe_2O_3+Al_2O_3$)	33·960	30·27	32·86	25·47	28·99	28·63	26·00	28·16	27·90
Fe_2O_3	12·960	14·30	15·00	11·92	12·30	13·27	12·27	13·00	11·92
Al_2O_3	21·000	15·97	17·86	13·55	16·69	15·36	13·73	15·16	15·98
CaO	0·120	0·120	0·10	0·09	0·09	0·06	0·09	0·18	0·10
MgO	0·100	0·120	0·07	0·206	0·07	Traces.	0·184	0·112	Traces.
K_2O	0·190	0·15	0·15	0·113	0·156	0·178	0·142	0·121	0·110
Na_2O	0·030	0·04	0·01	0·017	0·100	0·407	Traces.	0·016	0·201
P_2O_5	0·120	0·09	0·06	0·103	0·070	0·070	0·110	0·070	0·070
Nitrogen	0·159	0·120	0·09	0·168	0·112	0·098	0·154	0·126	0·094
Carbon	2·000	1·00	0·77	2·120	1·220	0·960	1·760	0·970	0·640
Availables—									
P_2O_5	0·0012	0·0007	Traces.	0·0014	0·0009	Traces.	0·0014	0·0006	Traces.
K_2O	0·0170	0·010	0·0054	0·0074	0·0054	0·0064	0·0160	0·0090	0·008
Mechanical analysis.									
Clay	42·89	40·05	40·00	43·54	45·50	47·14	40·94	41·44	44·21
Silt	20·25	18·89	20·15	6·51	11·74	11·00	11·51	12·76	11·24
Fine sand	11·15	11·20	11·05	13·05	12·56	10·21	15·15	13·13	14·80
Coarse sand	23·25	28·20	27·30	33·20	26·20	27·25	28·10	28·65	26·15
Acid solubles	2·46	1·66	1·50	3·70	4·00	4·00	4·30	4·02	3·60
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

TABLE No. 8.—*Soil moisture variations in the pre-bearing orchard, Kottaram.*

Treatments.	Months.	0′—1′	1′—2′	2′—3′	3′—4′
1 No digging (control) ..	November 1949	16·07 ; 16·50	17·01 ; 20·20	19·70 ; 24·20	19·90 ; 24·10
	March 1950	11·30 ; 16·40	14·20 ; 16·40	16·00 ; 16·50	12·60 ; 16·90
2 Mulching	November 1949	14·00 ; 15·93	15·46 ; 18·90	16·87 ; 21·60	20·60 ; 21·30
	March 1950	13·60 ; 13·20	15·80 ; 19·50	27·10 ; 19·80	16·10 ; 17·10
3 Cover crop	November 1949	13·60 ; 12·20	15·10 ; 18·00	18·20 ; 19·95	15·60 ; 21·60
	March 1950	10·80 ; 11·70	12·70 ; 13·10	12·30 ; 14·10	13·00 ; 14·00

NOTE.—Soil moisture has been estimated at two different spots for each treatment.

TABLE No. 9.—*Cyclone-affected soils*—1949 (*solubles salts—Percentage on air dry basis*).

Serial numbers.	Village.	Foot.	Chlorides.	Carbonates.	Bicarbonates.	Sodium-chloride.	Sodium carbonate.	Sodium bicarbonate.	Total solids.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			PITHAPURAM TALUK.						
1	Subbampet	First	0·1167	..	0·0183	0·2751	..	0·0253	0·7660
2	Do.	Second	0·1316	..	0·0305	0·5208	..	0·0420	0·6995
3	Ponnada	First	0·0533	..	0·0183	0·0878	..	0·0253	0·4145
4	Do.	Second	..	0·0060	0·0305	0·0351	0·0106	0·0420	0·1580
5	Do.	First	0·1598	..	0·0183	0·2634	..	0·0253	0·5300
6	Do.	Second	0·3799	..	0·0305	0·6261	..	0·0420	1·0700
7	Nagulapalli	First	0·0639	..	0·0122	0·1053	..	0·0168	0·2100
8	Do.	Second	0·0284	..	0·0066	0·0468	..	0·0084	0·1550
9	Nadanuduru	First	0·0852	0·0060	0·0671	0·1404	0·0106	0·0924	0·2640
10	Do.	Second	0·1456	0·0060	0·0671	0·2400	0·0106	0·0924	0·3950
11	Do.	First	0·2556	..	0·0427	0·4212	..	0·0588	0·6760
12	Do.	Second	0·4047	0·0060	0·0305	0·6671	0·0106	0·0420	0·9250

TABLE No. 9.—*Cyclone-affected soils*—1949 (*solubles salts—Percentage on air dry basis*)—cont.

Serial number.	Village.	Foot.	Chlorides.	Carbonates.	Bicarbonates.	Sodium chloride.	Sodium carbonate.	Sodium bicarbonate.	Total solids.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			KAKINADA TALUK.						
13	Penukuduru	First	0·1775	0·0180	0·0366	0·2925	0·0318	0·0504	0·5190
14	Do.	Second	0·0711	0·0120	0·0854	0·1171	0·0212	0·1176	0·3020
15	Guruzanpalli	First	0·0675	0·0120	0·0610	0·1113	0·0212	0·0840	0·2980
16	Do.	Second	0·0639	0·0120	0·0244	0·1053	0·0212	0·0336	0·2600
17	Pattavala	First	0·6923	..	0·0488	1·1410	..	0·0672	1·2900
18	Do.	Second	1·1360	0·0120	0·0183	1·8730	0·0212	0·0252	2·3150
19	Coringa	First	0·3515	..	0·0122	0·5793	..	0·0168	0·7830
20	Do.	Second	0·4580	..	0·0122	0·7550	..	0·0168	0·9300
			NARASAPURAM TALUK.						
21	Marithippa	First	0·0923	0·0060	0·0793	0·1522	0·0106	0·1092	0·3300
22	Do.	Second	0·1456	0·0060	0·0610	0·2400	0·0106	0·0840	0·4150
23	Lakshmaneswaram	First	0·1882	0·0120	0·0854	0·3102	0·0212	0·1176	0·5020
24	Do.	Second	0·4757	..	0·0366	0·7839	..	0·0504	0·9900
25	Muthayalapalli	First	0·2808	..	0·0305	0·4630	..	0·0420	0·6160
26	Do.	Second	0·0995	..	0·0732	0·1640	..	0·1008	0·2845
27	Kalipatnam	First	0·1458	..	0·0305	0·2403	..	0·0420	0·3100
28	Do.	Second	..	..	0·0244	0·3516	..	0·0336	0·4800
29	Do.	First	0·1599	..	0·0427	0·2636	..	0·0588	0·4830
30	Do.	Second	0·0639	..	0·0610	0·1053	..	0·0840	0·2050
31	Godilanka	First	0·0320	..	0·0671	0·0527	..	0·0924	0·1500
32	Do.	Second	0·0213	..	0·0549	0·0351	..	0·0756	0·1540
			AMALAPURAM TALUK.						
33	Kommara	First	0·1137	Trace.	0·0366	0·1874	Trace.	0·0504	0·2830
34	Giripatnam	Second	0·2453	Do.	0·0305	0·4042	Do.	0·0420	0·5580
35	Challapalli	First	0·1176	0·0060	0·0732	0·1938	0·0106	0·1008	0·3090
36	Do.	Second	0·0356	0·0120	0·0488	0·0587	0·0212	0·0672	0·1780
37	Do.	First	0·0711	..	0·1037	0·1171	..	0·1428	0·3210
8	Do.	Second	0·0852	..	0·0610	0·1404	..	0·0840	0·2950

39	Gopavaram	..	..	First	..	..	0·2257	..	0·0976	0·3720	..	0·1344	0·5400
40	Do.	..	..	Second	..	..	0·1704	0·0060	0·0488	0·2808	0·0106	0·0672	0·4350
41	Uppalaguptam	..	..	First	..	..	0·3449	..	0·0427	0·5684	..	0·0588	0·7530
42	Do.	..	..	Second	..	..	0·4833	0·0060	0·0366	0·7966	0·0106	0·0504	0·9930
43	Gollavalli	..	..	First	..	..	0·0639	..	0·0610	0·0053	..	0·0840	0·2000
44	Do.	..	..	Second	..	..	0·0639	..	0·0427	0·1053	..	0·0588	0·1650
45	Gogunamattam	..	..	First	..	..	0·0071	..	0·0305	0·0117	..	0·0420	0·0680
46	Do.	..	..	Second	..	..	0·0071	..	0·0305	0·0117	..	0·0420	0·0750
47	Kesavapalli	..	..	First	..	..	0·0747	0·0120	0·0488	0·1231	0·0212	0·0672	0·2050
48	Do.	..	..	Second	..	..	0·0924	..	0·0671	0·1523	..	0·0924	0·2475

Razole Taluk.

49	Sankarapuram	..	..	First	..	..	0·2166	..	0·0671	0·3571	..	0·0924	0·5850
50	Do.	..	..	Second	..	..	0·4296	..	0·0549	0·7081	..	0·0756	1·0500
51	Gudapalli	..	..	First	..	..	0·0852	0·0060	0·0610	0·1404	0·0106	0·0840	0·2840
52	Do.	..	..	Second	..	..	0·1030	..	0·0610	0·1697	..	0·0840	0·2980
53	Kesavadasapalem		..	First	..	..	0·1740	0·0120	0·0793	0·2867	0·0212	0·1092	0·5330
54	Do.		..	Second	..	..	0·3976	..	0·0427	0·6554	..	0·0588	0·9650
55	Anthurvedi	..	..	First	..	..	0·2698	..	0·0549	0·4447	..	0·0756	0·6180
56	Do.	..	..	Second	..	..	0·3195	..	0·0488	0·5266	..	0·0672	0·7090
57	Gudimodu	..	..	First	..	..	0·0781	..	0·0549	0·1287	..	0·0756	0·2700
58	Do.	..	..	Second	..	..	0·1740	..	0·0488	0·2867	..	0·0672	0·4300

Bhimavaram Taluk.

59	Naidupalem	..	..	First	..	..	0·4869	..	0·0366	0·8024	..	0·0504	1·1780
60	Do.	..	..	Second	..	..	0·8286	0·0060	0·0244	1·3660	0·0106	0·0336	1·8850
61	Thonathippa	..	..	First	..	..	0·0889	0·0060	0·0305	0·1465	0·0106	0·0420	0·2850
62	Do.	..	..	Second	..	..	0·0711	0·0060	0·0488	0·1170	0·0106	0·0672	0·2350
63	Gollavamithippa		..	First	..	..	0·1066	..	0·0427	0·1757	..	0·0588	0·5080
64	Do.		..	Second	..	..	0·3378	..	0·0244	0·5567	..	0·0336	2·0830
65	Kalavapudi	..	..	First	..	..	0·2204	..	0·0305	0·3633	..	0·0420	0·6480
66	Do.	..	..	Second	..	..	0·3844	..	0·0185	0·6336	..	0·0252	1·6200

TABLE No. 10.—*Total solids in the soils of cyclone-affected areas 1945 and 1949 compared.*

(Percentage on air dry basis.)

Taluk.	Village.	Foot.	1945.	1949.
Pithapuram	Subbampet	First	0·248	0·766
	Do.	Second	0·358	0·700
	Ponnada	First	0·154	0·415
	Do.	Second	0·103	0·158
	Nagulapalle	First	0·027	0·210
	Do.	Second	0·046	0·155
	Nadakaduru	First	0·693	0·676
	Do.	Second	0·476	0·925
Kakinada	Guruzampalle	First	0·376	0·298
	Do.	Second	0·468	0·260
	Pattawala	First	0·685	1·290
	Do.	Second	1·171	2·315
	Coringa	First	0·805	0·783
	Do.	Second	0·856	0·930
	Komaragiripatnam.	First	2·841	0·283
	Do.	Second	1·390	0·558
Amalapuram	Chalapalli	First	0·100	0·309
	Do.	Second	0·090	0·178
	Uppalaguptam	First	0·573	0·753
	Do.	Second	0·558	0·993
	Gollavalli	First	0·348	0·200
	Do.	Second	0·230	0·165
Razole	Goganamattam	First	0·526	0·068
	Do.	Second	0·519	0·075
	Kesavapalli	First	0·694	0·205
	Do.	Second	0·613	0·248
	Sankaraguptam	First	0·158	0·585
	Do.	Second	0·240	1·050
	Gudapalli	First	0·268	0·284
	Do.	Second	0·198	0·298
	Kesavadasapalem.	First	0·080	0·533
	Do.	Second	0·109	0·965
	Anthervedi	First	0·160	0·618
	Do.	Second	0·115	0·709
	Gudimoola	First	0·130	0·270
	Do.	Second	0·147	0·430
Narasapur	Marithippa	First	0·314	0·330
	Do.	Second	0·176	0·415
	Lakshmaneswaram.	First	0·096	0·502
	Do.	Second	0·091	0·990
	Muthayalapalli	First	2·231	0·616
	Do.	Second	2·526	0·285
	Kalipatnam	First	0·385	0·483
	Do.	Second	0·142	0·205
Bhimavaram	Naidupalayam	First	0·641	1·178
	Do.	Second	1·730	1·885
	Thokathippa	First	1·666	0·285
	Do.	Second	1·120	0·235

Fallow and cropped series—Each value is a mean of 4 independent determinations.

Fallow area.

—	23rd August 1949.	13th September 1949.	20th September 1949.	14th October 1949.	29th October 1949.	15th November 1949.	30th November 1949.	15th December 1949	29th December 1949.	17th January 1950.	31st January 1950.	17th February 1950.
1 Control	8·09	8·20	8·07	7·65	7·97	8·08	8·06	8·09	7·75	7·66	7·72	7·94
2 Leaf alone	8·43	8·24	8·12	7·85	8·03	7·99	8·11	8·02	7·86	7·76	7·94	7·94
3 Leaf + 30 N	8·25	8·24	8·08	7·74	7·92	7·97	8·11	7·98	7·73	7·74	8·01	7·93
7 30 P_2O_5	8·10	8·19	8·14	7·71	7·88	7·98	8·10	7·97	7·82	7·75	7·96	7·93
8 Leaf + 30 P_2O_5	8·14	8·23	8·08	7·78	7·98	7·98	8·05	8·12	7·75	7·68	8·00	7·94
9 Leaf + 30 P_2O_5 + 30 N	8·12	8·27	8·05	7·87	7·98	7·94	8·15	8·05	7·94	7·65	7·95	7·94
19 60 K_2O	8·16	8·25	8·03	7·97	7·98	7·98	8·11	8·05	7·85	7·72	7·91	7·96
20 Leaf + 60 K_2O	8·05	8·21	8·10	7·75	7·97	7·95	8·14	7·99	7·82	7·71	7·91	7·93
21 Leaf + 60 K_2O + 30 N	7·97	8·23	8·08	7·67	7·97	7·97	8·13	8·06	7·96	7·80	7·96	7·93
25 30 P_2O_5 + 60 K_2O	8·26	8·25	8·13	7·78	8·03	7·94	8·08	7·99	7·83	7·80	7·99	7·96
26 Leaf + 30 P_2O_5 + 60 K_2O	8·36	8·20	8·06	7·60	7·91	7·99	8·13	8·11	7·78	7·67	7·99	7·94
27 Leaf + 30 P_2O_5 + 60 K_2O + 30 N.	8·16	8·22	8·08	7·78	7·94	8·02	8·02	8·06	7·85	7·63	7·94	7·94
	Field condition.	Field condition addition water.	Field condition.	Field condition.	Dry.	Dry.	Plenty of water.	Dry.	Dry.	Dry.	Dry.	Dry.

Cropped area.

—	August.	September.		October.		November.		December.		January.		February.
1 Control	8·09	8·30	8·06	7·93	7·92	7·73	7·93	7·97	7·95	7·92	7·94	8·03
2 Leaf alone	8·30	8·25	8·07	7·97	7·85	7·80	7·99	7·98	7·85	7·92	8·00	8·02
3 Leaf + 30 N	8·25	8·19	8·16	7·98	7·87	7·76	7·95	7·93	7·75	7·92	7·92	8·00
7 30 P_2O_5	8·18	8·34	8·10	7·91	7·85	7·81	7·94	7·97	7·78	7·91	7·98	7·98
8 Leaf + 30 P_2O_5	8·08	8·19	8·08	7·98	7·84	7·71	7·88	7·96	7·79	7·85	7·91	8·00
9 Leaf + 30 P_2O_5 + 30 N	8·31	8·17	8·11	7·86	7·86	7·79	7·95	8·01	7·68	8·00	7·93	7·98
19 60 K_2O	8·18	8·26	8·10	7·95	7·85	7·81	7·89	7·99	7·79	7·99	7·93	8·00
20 Leaf + 60 K_2O	8·20	8·19	8·12	7·93	7·85	7·81	7·92	7·98	7·73	8·03	8·04	8·03
21 Leaf + 60 K_2O + 30 N	8·30	8·20	8·11	7·97	7·86	7·72	7·93	7·96	7·71	7·97	8·01	8·03
25 30 P_2O_5 + 60 K_2O	8·18	8·18	8·18	7·91	7·86	7·75	7·87	7·99	7·76	7·99	7·94	8·00
26 Leaf + 30 P_2O_5 + 60 K_2O	8·09	8·31	8·16	7·99	7·85	7·76	7·89	7·99	7·88	7·97	7·91	8·01
27 Leaf + 30 P_2O_5 + 60 K_2O + 30 N.	8·06	8·17	8·10	7·86	7·84	7·85	7·93	8·02	7·77	7·88	7·91	8·02

TABLE No. 12.—1948–49—*Salt content of plots under different irrigation.*

(Average of four replications—Percentage on air dry basis—Total solids.)

	First foot.	Second foot.	Third foot.	Average of three feet.
Ryots' method	0·0823	0·0971	0·1240	0·1015
Two inches once in 15 days	0·0936	0·1011	0·1295	0·1069
Three inches once in 15 days	0·0836	0·0971	0·1143	0·0983
Three inches once in 30 days	0·0899	0·1093	0·1382	0·1128
No irrigation	0·0893	0·1025	0·1338	0·1085
Pre-irrigation *	..	..	..	0·1150

* First, second and third foot figures separately are not available.

TABLE No. 13.—1949–50—*Salt content of plots under different irrigation.*

(Single plot values—Total solids—Percentage on air dry basis.)

	First foot.	Second foot.	Third foot.	Average of three feet.
Ryots' method	0·0920	0·0950	0·1110	0·0993
Two inches once in 15 days	0·0890	0·1020	0·1260	0·1057
Three inches once in 15 days	0·0720	0·1155	0·1270	0·1048
Three inches once in 30 days	0·0765	0·0940	0·1150	0·0952
No irrigation	0·1135	0·1280	0·1650	0·1355
Pre-irrigation	..	..	..	0·1150

TABLE No. 14.—*Average salt content of top three feet.*

(Percentage on air dry basis—Single plot values.)

	1947–48.	1948–49.	1949–50.
No irrigation	0·1127	0·1289	0·1355
Ryots' method	0·0917	0·0945	0·0993
Two inches once in 15 days	0·1083	0·1053	0·1057
Three inches once in 15 days	0·1048	0·1047	0·1048
Three inches once in 30 days	0·1210	0·0967	0·0952

TABLE No. 15.—*Total water soluble salts in the heavy irrigated profiles,* 1948–49.

(Percentage on air dry basis.)

Block V—Wet lands.	First foot.	Second foot.	Third foot.	Average of three feet.
Single-crop area—				
(i) Pre-irrigation in 1939	0·1650	0·7900	0·9460	0·6337
(ii) Post-irrigation in 1948	0·0880	0·1068	0·2624	0·1524
Sugarcane-paddy rotation—				
(i) Post-irrigation in 1948	0·1006	0·1159	0·1385	0·1183
(ii) Pre-irrigation in 1939	0·1060	0·5860	0·4620	0·3847
Double crop paddy—				
(i) Pre-irrigation in 1939	0·1650	0·7900	0·9460	0·6337
(ii) Post-irrigation in 1948	0·0816	0·0797	0·0914	0·0842

TABLE NO. 16.—*Average salt content of top three feet layers*, 1939–48.

1939	0·6337	0·6337	0·3847
1940	0·5653	..	0·1920
1941	0·2107	..	0·1983
1942	0·2703	0·2404	0·1227
1943	0·2605	0·1469	0·1375
1944	0·1253	0·0895	0·1123
1945	0·1116	0·0842	0·1066
1946	0·1332	0·0861	0·1311
1947	0·1023	0·0870	0·1024
1948	0·1524 *	0·0842	0·1183

* Though this value (average of top three feet) is a bit high, the first and second foot values as in Table No. 15 are only low.

TABLE NO. 17.—*Amount of washing down of salts as in* 1948 (Shown as per cent of pre-irrigation figure.)

	First foot.	Second foot.	Third foot.	Average of three feet.
Single-crop area	46·7	86·5	72·3	68·5
Double-crop area	50·4	90·0	90·0	76·8
Sugarcane-paddy rotation area	5·1	81·6	70·0	52·2

TABLE NO. 18.—*Total water soluble salts in wet lands*, 1949–50. (Per cent on air dry basis.)

Bl. V Plots 4, 5, 14, 15, 7, 8, 17, 18.

	First foot.	Second foot.	Third foot.	Average of three feet.
1. Single-crop area—				
(i) Pre-irrigation (1939)	0·1650	0·7900	0·9460	0·6337
(ii) Post-irrigation (1949) (average of 4 replications) Plots 4, 5, 14 and 15.	0·0993	0·1413	0·3946	0·2117
2. Sugarcane-paddy rotation—				
(i) Pre-irrigation (1939)	0·1060	0·5860	0·4620	0·3847
(ii) Post irrigation (1949) (average of 4 replications) Plots 7, 8, 17 and 18.	0·0980	0·1143	0·1315	0·1146

Average salt content of top three feet layers of the plots under present experiment (for years 1946 *to* 1949).

Year of experiment.	Plots 7, 8, 17 and 18. Single-crop area.	Plots 4, 5, 14 and 15. Sugarcane-paddy rotation.
1946–47	0·1732	0·1046
1947–48	0·2178	0·1099
1948–49	0·2689	0·1183
1949–50	0·2117	0·1146

TABLE NO. 19.—*Total nitrogen content of wet land soils.* (Per cent on dry basis—Average of two replicatiyons.)

	First foot.	Second foot.	Third foot.
1 Single-crop area	0·0683	0·0390	0·0295
2 Sugarcane-paddy rotation area	0·0540	0·0360	0·0320

TABLE No. 20.—*Organic matter content of wet land soils.*
(Per cent on dry basis—Average of two replications.)

	First foot.	Second foot.	Third foot.
1 Single-crop area	0·918	0·486	0·386
2 Sugarcane-paddy rotation area	0·789	0·479	0·438

TABLE No. 21.—*Available phosphoric acid content—Wet land soils.*
(Per cent on dry basis—Average of two replications.)

	First foot.	Second foot.	Third foot.
1 Single-crop area	0·0218	0·0130	0·0136
2 Sugarcane-paddy rotation area	0·0215	0·0135	0·0150

TABLE No. 22.—*Exchangeable bases in wet land soils.*
(Mill equivalents per cent on dry basis—Average of two replications.)

	First foot.	Second foot.	Third foot.
1 Exchangeable sodium—			
(i) In single-crop area	5·18	7·07	7·62
(ii) Sugarcane area	4·73	7·50	7·78
2 Exchangeable potassium—			
(i) Single-crop area	0·54	0·69	0·75
(ii) Sugarcane-paddy area	0·66	0·67	0·73
3 Total exchangeable bases—			
(i) Single-crop area	51·28	60·09	63·27
(ii) Sugarcane-paddy area	52·18	58·84	62·44
4 Degree of alkalization—			
(i) In single-crop area	11·21	12·94	13·22
(ii) Sugarcane-paddy area	10·42	13·90	13·68

TABLE No. 23.—*Mechanical composition of wet land soils.*
(Average of two replications—Per cent on dry basis.)

	First foot.	Second foot.	Third foot.
1 Fine fraction—			
(i) Single-crop area	73·64	79·69	77·29
(ii) Sugarcane-paddy area	71·45	76·37	76·54
2 Coarse fraction—			
(i) Single-crop area	19·72	15·09	15·73
(ii) Sugarcane-paddy area	23·28	19·53	19·12

TABLE No. 24.—*pH values of wet land soils.*
(Average of two replications.)

	First foot.	Second foot.	Third foot.
1 Single-crop area	8·09	8·65	8·63
2 Sugarcane-paddy area	7·93	8·68	8·73

TABLE No. 25.—*Block VIII—Garden land.*

(Total solid content—Per cent on air dry basis.)

	First foot.	Second foot.	Third foot.	Average.
1 Cotton	0·0928	0·1115	0·1177	0·1073
2 Wheat	0·0922	0·1065	0·1250	0·1079
3 Jonna	0·0958	0·1118	0·1267	0·1114
4 Groundnut	0·0935	0·1110	0·1323	0·1123

TABLE No. 26.—*Salt content of Tungabhadra river and Sirugguppa channel for the year* 1949–50.

(Parts per 100,000.)

	Tungabhadra river.	Siruguppa channel at 0/4 spot.	Siruguppa channel at 5/1 spot.
July 1949	33·8	33·7	45·2
August 1949	25·8	24·7	27·0
September 1949	23·0	22·7	25·3
October 1949	13·3	12·2	12·7
November 1949	12·5	12·0	11·8
December 1949	8·2	5·1	7·7
January 1950	8·2	8·0	7·9
February 1950	4·1	3·9	4·2
March 1950	5·2	5·3	4·4
April 1950	8·2	8·0	5·7
May 1950	1·8	2·7	..
June 1950	75·7	76·1	77·6

TABLE No. 27.—*Results of comparative value of common green manures—Experiment*, 1949–50—
A. Block wet lands—Green manure.

Layout—4 × 4 randomized blocks.
Area of each plot—5 cents.
Variants—Daincha, Pillipesara, Sunnhemp and Cowpea.

Sown—28th April 1949.
Harvested—18th and 19th July 1949.

Particulars.	Sunnhemp.	Daincha.	Pillipesara.	Cowpea.	General mean.	'Z' test satisfied or not.	Standard error.	Critical difference.
Green matter—Yield lb./acre ..	27,790	21,120	21,305	21,055	22,818	..	..	..
Dry matter do. ..	6,565	4,455	3,385	2,905	4,328	Yes.	493·8	1117
Percentage over general mean ..	151·7	102·9	78·20	67·11	100	..	11·41	25·80

Conclusion—Sunnhemp, Daincha, Pillipesara, Cowpea.

TABLE No. 28.—*Comparative value of common green-manure crops—Experiment*, 1949–50—
D. Block wet lands—Green manure.

Area of plot—5·2 cents.
Layout—4 × 5 randomized block.
Variants—Daincha, Pillipesara, Sunnhemp and Cowpea.

Sown—7th and 8th May 1949.
Harvested—26th, 27th and 28th July 1949.

Particulars.	Sunnhemp.	Daincha.	Pillipesara.	Cowpea.	General mean.	'Z' test satisfied or not.	Standard error.	Critical difference.
Green matter yield lb./acre	25,816	21,131	22,337	19,246	22,133	..	..	..
Dry matter do.	5,701	4,645	3,357	3,119	4,203	Yes.	377·7	852·7
Percentage on general mean	135·7	110·5	79·89	74·22	100	..	8·99	20·29

Conclusion—Sunnhemp, Daincha, Pillipesara, Cowpea.

TABLE NO. 29.—*Yield of green manure and nitrogen added, 1948–49 and 1949–50—A. Block.*

Green manure.	Yield of green manure lb./acre.		Nitrogen per cent.		Nitrogen added lb. per acre.	
	1948–49.	1949–50.	1948–49.	1949–50.	1948–49.	1949–50.
1 Daincha ..	18,665	21,120	2·57	2·38	132·7	94·75
2 Pillipesara.	18,648	21,305	2·56	3·41	101·9	105·40
3 Sunnhemp.	21,605	27,790	2·26	1·75	133·8	104·90
4 Cowpea ..	20,438	21,055	2·31	2·65	74·1	69·66

TABLE NO. 30.—*D. Block.*

Green manure.	Yield of green manure lb./acre.		Nitrogen per cent.		Nitrogen added lb. pee acre.	
	1948–49.	1949–50	1948–49.	1949–50.	1948–49.	1949–50.
1 Daincha ..	30,895	21,131	1·76	2·68	115·6	112·40
2 Pillipesara.	20,821	22,337	2·46	2·59	56·6	84·35
3 Sunnhemp.	13,167	25,816	1·52	1·53	48·6	78·72
4 Cowpea ..	22,253	19,246	1·88	2·53	50·5	71·86

TABLE No. 31.—*Paddy.*

Layout—4 × 5 randomized blocks.
Transplanted—8th and 9th August 1949.
Harvested—7th and 8th December 1949.

Particulars.	Pillipesara.	Cowea.	Daincha.	Sunnhemp.	Control.	General mean.	'Z' test satisfied or not.	Standard error.	Critical difference.
				GRAIN.					
Acre yield in lb. ..	3,495	3,105	2,975	2,975	1,770	2,864	..	176·64	237·0
Percentage on control ..	197·4	175·4	168·1	168·1	100	161·8	Yes.	9·98	13·34
				STRAW.					
Acre yield in lb. ..	4,735	4,400	3,815	3,710	2,000	3,732	..	314	376
Percentage on control ..	236·8	220·0	190·8	185·5	100	186·6	Yes.	15·70	18·80

Conclusions—
Grain : Pillipesara, Cowpea, Daincha, Sunnhemp, Control.
Straw : Pillipesara, Cowpea, Daincha, Sunnhemp, Control.

TABLE No. 32.—*Paddy.*

Layout—5 × 5 randomized block.
Transplanted—19th to 22nd August 1949.
Harvested—11th to 15th December 1949.

Particulars.	Daincha.	Pillipesara.	Cowpea.	Sunnhemp.	Control.	General mean.	'Z' test satisfied or not.	Standard error.	Critical difference.
				GRAIN.					
Acre yield in lb. ..	3,703	3,577	3,538	3,480	2,519	3,364	..	181·1	287·7
Percentage on control ..	147·0	142·0	140·5	138·6	100	133·6	Yes.	7·19	11·42
				STRAW.					
Acre yield in lb. ..	5,484	5,416	4,842	5,335	3,096	4,837	..	401·6	546·1
Percentage on control ..	177·1	174·9	156·4	172·4	100	156·2	Yes.	12·96	17·64

Conclusions—
Grain : Daincha, Pillipesara, Cowpea, Sunnhemp, Control.
Straw : Daincha, Pillipesara, Sunhemp, Cowpea, Control.

TABLE No. 33.—*Ammoniacal and total nitrogen content of drainage water from pots—Green-manure decomposition studies.*

Number and treatments.	Number of round.	Am. nitrogen mgms. from 11,000 gms. of soil.					Total N. mgms. from 11,000 gms. of soil.				
		I.	II.	III.	IV.	V.	I.	II.	III.	IV.	V.
I. No manure ..	Uncropped.	1·52	0·72	0·89	1·58	1·02	12·60	9·19	7·39	9·55	46·35
	Cropped ..	1·26	0·69	0·64	0·65	0·62	10·42	10·95	7·84	5·13	49·38
II. Green manure at 5,000 lb. per acre.	Uncropped.	1·09	0·58	1·04	1·11	1·01	17·71	8·70	15·09	5·54	22·48
	Cropped ..	0·99	0·52	0·75	0·87	0·85	15·71	8·52	16·32	4·62	15·15
III. Ammonium sulphate N = Treatment II.	Uncropped.	1·55	0·56	0·78	0·68	0·91	9·55	12·10	6·47	4·93	13·24
	Cropped ..	1·49	1·01	0·63	0·67	0·67	8·61	10·40	6·50	3·29	9·86
IV. Green manure at 10,000 lb./ acre.		0·82	0·81	0·85	1·36	1·25	9·16	9·34	9·45	11·83	19·83
V. Ammonium sulphate N = Treatment IV.		0·94	0·75	0·82	1·31	0·73	17·19	17·85	11·09	8·55	16·58
VI. Combination—Treatments II plus III.		1·16	0·86	0·93	1·21	0·92	11·89	11·18	7·39	9·68	14·38

TABLE No. 34.—*Oxygen requirement and pH of drainage waters.*

Treatments.	First Round.			Second Round.			Third Round.			Fourth Round.			Fifth Round.		
	Oxygen demand.		pH.	Oxygen demand.		pH.	Oxygen demand.		pH.	Oxygen demand.		pH.	Oxygen demand.		pH.
	Cold.	Hot.		Cold.	Hot.		Cold.	Hot.		Cold.	Hot.		Cold.	Hot.	
1 No manure, uncropped	..	..	7·36	1·10	11·28	7·21	4·68	10·18	7·57	3·85	7·43	7·31	8·85	15·40	7·12
2 No manure, cropped	..	..	7·49	1·38	2·57	7·24	4·54	10·73	7·68	3·30	8·55	7·47	9·36	19·66	7·26
3 G.M.S.D., uncropped	..	..	7·26	6·33	16·50	7·48	4·95	11·28	7·48	3·58	13·48	7·36	10·40	22·10	7·11
4 G.M., single dose	..	..	7·30	8·11	17·42	7·69	4·40	12·56	7·47	5·39	19·80	7·47	10·40	19·83	7·24
5 AmS04, single dose, uncropped	..	..	7·32	6·60	17·60	7·25	3·58	9·49	7·45	2·20	4·40	7·24	6·39	14·36	7·18
6 ,, ,, single dose	4·28	25·58	7·48	7·43	26·26	7·25	3·85	11·90	7·69	2·89	8·11	7·34	7·07	16·26	7·29
7 G.M., double dose	..	..	7·35	7·84	21·04	7·70	5·36	14·03	7·54	4·04	17·38	7·46	5·47	20·79	7·15
8 AmS04, double dose	1·38	11·0	7·38	8·54	17·74	7·44	4·70	14·06	7·38	4·16	13·02	7·22	4·91	15·89	7·32
9 Combinations	1·65	14·3	7·34	7·70	17·46	7·64	5·30	12·10	7·53	3/30	14·14	7·32	5·60	17·98	7·35

TABLE No. 35.—*Pot-culture experiments (O.P.M. Field K plus P plots).*

(Average per pot of 4 replications.)

	Grain. GMS.	Straw. GMS.	Remarks.
1 No manure	4·85	7·11	The plants were attacked by wilt disease in all the green-manured plots.
2 Green manure (single dose) ..	3·32	6·34	
3 Ammonium sulphate (single dose).	5·93	7·84	
4 Green manure (double dose)	4·73	8·15	
5 Ammonium sulphate (double dose).	8·04	11·19	
6 Combination of 2 and 3.. ..	6·49	8·84	

TABLE No. 36.—(1949–50) *Pot-culture experiments with D. Block soil yield data in gms.*

(Average of 4 pots.)

Treatments.	Grain. GMS.	Straw. GMS.	Remarks.
1 No manure	12·58	15·23	
2 Green manure at 5,000 lb./acre ..	12·78	16·93	
3 Ammonium sulphate at N = 2.	11·91	16·13	
4 Green manure at 10,000 lb./acre.	8·44	11·42	
5 Ammonium sulphate at N = 4.	10·80	12·69	
6 Combination—treatments 2 and 3.	11·23	12·68	

TABLE No. 37.—*Green manuring of paddy—Pot-culture experiments—Nitrogen balance sheet.*

Treatments.	I		II		III		IV	V	VI
	Uncropped.	Cropped.	Uncropped.	Cropped.	Uncropped.	Cropped.	Cropped.	Cropped.	Cropped.
Nitrogen supplied (in gms.)—									
(1) Soil—11,000 gms.	3·4188	3·4188	3·4188	3·4188	3·4188	3·4188	3·4188	3·4188	3·4188
(2) Sand—1,000 gms.	0·0308	0·0308	0·0308	0·0308	0·0308	0·0308	0·0308	0·0308	0·0308
(3) Manure	..	..	0·1174	0·1174	0·1174	0·1174	0·2348	0·2348	0·2348
(4) Seedlings	..	0·0148	..	0·0148	..	0·0148	0·0148	0·0148	0·0148
Total ..	3·4496	3·4644	3·5670	3·5818	3·5670	3·5818	3·6992	3·6992	3·6992
Nitrogen recovered—									
(1) Drainage water — I Round	0·0036	0·0030	0·0066	0·0059	0·0036	0·0042	0·0032	0·0047	0·0041
II Round	0·0037	0·0042	0·0032	0·0040	0·0053	0·0044	0·0040	0·0060	0·0039
III Round	0·0028	0·0034	0·0044	0·0057	0·0038	0·0023	0·0025	0·0036	0·0032
IV Round	0·0035	0·0020	0·0020	0·0019	0·0026	0·0015	0·0042	0·0029	0·0043
V Round	0·0160	0·0141	0·0068	0·0064	0·0060	0·0036	0·0070	0·0061	0·0062
(2) Residual soil	3·3348	3·4920	3·3120	3·3073	3·4860	3·5247	3·7972	3·6883	3·7968
(3) Plant material — Grain	..	0·0695	..	0·0692	..	0·0840	0·0967	0·1135	0·1029
Straw	..	0·0379	..	0·0665	..	0·0437	0·0845	0·0491	0·0628
Roots	..	0·0084	..	0·0121	..	0·0066	0·0108	0·0096	0·0083
Total ..	3·3644	3·6345	3·3350	3·4790	3·5073	3·6750	4·0101	3·8838	3·9925
Nitrogen balance— Gain or loss of N. Total under nitrogen supplied ± Total under nitrogen recovered.	−0·0852	+0·1701	−0·2320	−0·1028	−0·0597	+ 0·0932	+0·3109	+0·1846	+0·2933

TABLE No. 38—*Yield of paddy GEB 24 in green-manure decomposition studies—D. Block.*

Treatment.	Yield per acre. Grain. LB.	Straw. LB.
(1) No manure	2,830	3,560
(2) Green manure—Pillipesara at 4,000 lb./acre (single dose).	2,570	3,179
(3) Ammonium sulphate—N. equivalent to (2) single dose.	2,905	3,716
(4) Green manure, double dose	3,145	4,107
(5) Ammonium sulphate—Double dose N. equivalent to (4).	3,060	3,987
(6) Combination (2) and (3)	3,155	4,200

'Z' test was not satisfied.

TABLE No. 39—*Nitrogen content of some common green leaf-manure (percentages).*

	Datura.		Thevitia.		Cassia auriculata.	
	Leaves.	Stems.	Leaves.	Stems.	Leaves.	Stems.
Moisture	10·31	11·55	7·34	5·12	7·37	8·06
Nitrogen per cent on dry basis.	4·95	1·69	2·47	1·46	2·93	1·26

TABLE No. 40—*Green-leaf manures—Decomposability—N_2 content—Decomposability of some common green leaf manure.*

Serial number and name of green leaf manure.	Leaf. (a)	Leaf. (b)	Stem. (a)	Stem. (b)
1 Gliricidia	42·81	13·30	41·82	13·03
2 Calotropis	57·80	21·65	39·60	11·27
3 Croton sparciflorus	20·38	10·93	38·47	1·39
4 Pungam	28·93	7·25	31·09	5·61
5 Sesbania	10·87	118·7	14·78	197·3
6 Poovarasu	17·37	249·5	9·32	87·52
7 Delonix	19·73	318·2	14·55	192·8
8 Cassia siamea	21·77	338·0	14·04	182·5
9 Datura	12·82	214·2	16·67	308·5
10 Thevitia	26·57	551·1	22·48	450·7
11 Cassia auriculata	26·71	554·6	20·10	392·5

(a) Milligrams Co^2 evolved per day. (b) Percentage increase over control.

TABLE NO. 41.—*Yield data—Potato experiment, Agricultural Research Station, Nanjanad*, 1949–50.

(In pounds per plot.)

Sown—11th and 12th April 1949. Harvested—16th, 17th and 18th August 1949.

Replications.	I		II		III		IV		V		VI		VII		VIII	
	2N-5P-3K.		2N-3P-3K.		2N-1P-3K.		2N-0P-3K.		1N-5P-3K.		1N-3P-3K.		1N-1P-3K.		1N-0P-3K.	
	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
1	81	75½	87¼	66½	78¾	88¾	31½	78	67¼	75	61	80	74	53	55½	51¾
2	77½	80½	69	90	73¼	66¾	61½	63½	91½	77	90	71½	52	54½	27¾	66½
3	94¾	73¾	83	88¼	75¾	50½	63¼	39	77¼	85¾	75½	79¾	54¾	51½	61	57¼
4	80¾	95	77	79¾	54½	48¾	28	71¼	67½	84½	66½	70½	59¼	72½	28¼	29½
5	86	90	84¾	83½	61¾	45	50	34½	81½	86¾	80	82	60½	72¼	41	66¼
6	77½	73½	69	76¾	68¾	47¼	60¾	57¾	71¾	91	65	76½	56½	42	45¼	27½
7	86½	44	64½	74¾	66½	76	48	44¼	85¼	91	59¼	77¼	59½	65¾	45	41¾
8	86¾	78¼	93¾	71½	74½	76¾	49	54¾	74½	80	81¾	74¼	73¾	49½	36¾	57¾
Average per plot ..	83·84	76·31	78·53	78·87	69·22	62·47	49·0	55·38	77·06	83·88	72·32	76·47	61·28	57·63	42·56	49·78
Average acre yield ..	15,240	13,880	14,280	14,340	12,580	11,360	8,908	10,070	14,010	15,250	13,140	13,900	11,140	10,470	7,745	9,051

(*a*) No lime. (*b*) Lime.

TABLE No. 42.—*Experiment on reduction of manurial bill for potatoes at the Agricultural Research Station, Nanjanad* (1949–50).

1 Field Nos. 14-A and plots 1, 2 and 3 in field 1.

2 System of replication—Randomized blocks : 8 × 8 × 2.

3 Area of each plot—0·55 cents nett.

4 Soil—Laterite.

5 Treatments—

A. Lime series.

	N. LB.	P. LB.	K. LB.
1 N—0 P—3 K	40	0	100
1 N—1 P—3 K	40	40	100
1 N—3 P—3 K	40	120	100
1 N—5 P—3 K	40	200	100
2 N—0 P—3 K	80	0	100
2 N—1 P—3 K	80	40	100
2 N—3 P—3 K	80	120	100
2 N—5 P—3 K	80	200	100

B. No lime series.

1 N—0 P—3 K	40	0	100
1 N—1 P—3 K	40	40	100
1 N—3 P—3 K	40	120	100
1 N—5 P—3 K	40	200	100
2 N—0 P—3 K	80	0	100
2 N—1 P—3 K	80	40	100
2 N—3 P—3 K	80	120	100
2 N—5 P—3 K	80	200	100

6 Basal dressing—5 tons of cattle manure.

7 Date of manuring—Lime applied on 10th April 1949 and the rest on 11th April 1949.

8 Date of planting—11th and 12th of April 1949.

9 Date of harvesting—16th, 17th and 18th August 1949.

10 Variety—Great Scot.

1. *Lime.*

Particulars.	Mean yield of potatoes. Lime.	Mean yield of potatoes. No lime.	General mean.	S.E. of treatment.	Whether significant or not.	Critical difference P=0·05.
In pounds per acre	12,290	12,130	12,210	253·4	No.	710·9
As percentage on general mean.	100·7	99·3	100	2·07	..	5·82 per cent.
As percentage on control	101·4	100	..	..	..	..

Conclusion—Not significant.

TABLE No. 42.—*Experiment on reduction of manurial bill for potatoes at the Agricultural Research Station, Nanjanad* (1949–50)—cont.

2. Nitrogen

Particulars.	Mean yield of potatoes in pounds. Nitrogen 40 lb.	Nitrogen 80 lb.	General mean.	S.E. of treatment.	Whether effect of treatment is significant or not (P=0·05).	Critical difference. (P=0·05).
In pounds per acre	11,840	12,580	12,210	253·4	Yes.	710·9
As percentage on general mean.	96·9	103·0	100	2·1	..	5·82%
As percentage over 1 N ..	100%	106·3%	..	..	..	..

Conclusion—2 N > 1 N.

3. *Phosphoric Acid.*

Particulars.	Mean yield of potatoes in pounds. P_2O_5 0 lb.	40 lb.	120 lb.	200 lb.	General mean.	S.E. of treatment.	Whether effect of treatment is significant or not (P=0·05).	Critical difference. (P=0·05).
In pounds per acre.	9,910	11,390	13,920	14,600	12,455	358·3	Yes.	1,006 lb.
As percentage on general mean.	79·5	91·4	111·7	117·1	100	2·88	..	8·1 %
As percentage over 0 lb. P_2O_5.	100	114·9	140·5	147·3	..	..	..	..

Conclusion—3 P, 2 P, 1 P, 0 P.

TABLE No. 43.—*Economics of yield per acre—Potato experiment, Agricultural Research Station, Nanjanad.*

Treatment.	Particulars.	Unlimed. Rs.	A.	P.	Limed. Rs.	A.	P.
2N—0P—3K ..	Total value of wares	1,342	9	7	1,576	6	4
	Cultivation and manure charges.	827	12	2	934	4	4
	Profit	514	13	5	642	2	0
2N—1P—3K ..	Total value of wares	1,940	4	9	1,730	7	0
	Cultivation and manure charges.	853	12	8	960	4	10
	Profit	1,086	8	1	770	2	2
2N—3P—3K ..	Total value of wares	2,194	1	7	2,230	1	7
	Cultivation and manure charges.	906	0	1	1,012	8	3
	Profit	1,288	1	6	1,217	9	4
2N—5P—3K ..	Total value of wares	2,303	14	4	2,163	0	0
	Cultivation and manure charges.	956	12	0	1,063	4	2
	Profit	1,347	2	4	1,099	11	10
1N—0P—3K ..	Total value of wares	1,193	4	5	1,401	12	10
	Cultivation and manure charges.	802	0	2	908	8	4
	Profit	391	4	3	493	4	6
1N—1P—3K ..	Total value of wares	1,693	0	0	1,592	3	3
	Cultivation and manure charges.	827	15	10	934	8	0
	Profit	865	0	2	657	11	3
1N—3P—3K ..	Total value of wares	1,991	3	3	2,130	8	1
	Cultivation and manure charges.	880	4	1	986	12	3
	Profit	1,110	15	2	1,143	11	10
1N—5P—3K ..	Total value of wares	2,042	4	0	2,342	3	3
	Cultivation and manure charges.	931	0	0	1,037	8	2
	Profit	1,111	4	0	1,304	11	1

TABLE NO. 44.—*Tentative summary of the results of soil analysis.*

Average values of different treatments.

Treatments.	pH	Nitrogen.	Unlimed series. Total P_2O_5.	Available. P_2O_5.	Lime.	Organic carbon.
Single dose of nitrogen.						
1N + 0P + 3K ..	5·04	0·193	0·185	0·021	0·137	1·81
1N + 1P + 3K ..	5·08	0·207	0·171	0·015	0·156	2·00
1N + 3P + 3K ..	5·06	0·192	0·173	0·020	0·120	1·88
1N + 5P + 3K ..	5·22	0·182	0·272	0·022	0·157	2·24
Double dose of nitrogen.						
2N + 0P + 3K ..	5·26	0·206	0·267	0·022	0·141	2·26
2N + 1P + 3K ..	5·24	0·202	0·243	0·022	0·211	2·50
2N + 3P + 3K ..	5·28	0·199	0·191	0·024	0·136	2·27
2N + 5P + 3K ..	5·29	0·180	0·268	0·023	0·190	2·22

Treatment.	pH	Nitrogen.	Limed series. Total P_2O_5.	Available. P_2O_5.	Lime.	Organic carbon.
Single dose of nitrogen.						
1N + 0P + 3K ..	5·28	0·161	0·176	0·023	0·217	1·91
1N + 1P + 3K ..	5·36	0·164	0·182	0·010	0·177	1·13
1N + 3P + 3K ..	5·45	0·194	0·197	0·016	0·174	2·27
1N + 5P + 3K ..	5·36	0·192	0·208	0·020	0·186	2·14
Double dose of nitrogen.						
2N + 0P + 3K ..	5·28	0·199	0·184	0·034	0·197	2·63
2N + 1P + 3K ..	5·14	0·180	0·202	0·021	0·198	2·30
2N + 3P + 3K ..	5·31	0·189	0·194	0·023	0·252	2·29
2N + 5P + 3K ..	5·08	0·167	0·193	0·016	0·203	1·74

TABLE No. 45.—*Effect of pre-soaking paddy seed in phosphate solutions.*

culture experiment in 10″ × 10″ glazed pots. Paddy variety—Co. 13.

atments—13, each replicated 4 times in 2 pes of soils. Sown on 28th February 1949. Flowered—May 1949.

K and N K from the permanent manurial plots. Harvested—8th June 1949.

(*a*) *Summary of results from both soil types NK and NPK.*

Treatments (particulars).	Grain yield.		Strat yield.		Plant height (cms.)	Tillering.	Flowering (days).
	Mean per pot (in gms.)	Percentage on control =100.	Mean per pot (in gms.)	Percentage on control.			
ked (and dried in ½ weight f seed of distilled water)—							
1 Once	21·35	94·5	37·39	70·2	98·1	2·9	76
2 Thrice	17·50	77·5	33·00	63·6	94·6	2·8	79
aked—							
3 KH_2PO_4—10 per cent ..	21·35	94·5	45·50	84·7	99·2	3·4	77
4 Do. 20 per cent ..	20·88	92·4	58·44	112·7	101·1	3·5	77
5 K_2HPO_4—10 per cent ..	22·10	97·8	51·25	98·8	104·5	3·2	80
6 Do. 20 per cent ..	25·06	110·9	48·63	93·8	103·0	2·8	77
7 K_3PO_4—10 per cent ..	27·36	121·1	57·26	110·4	106·0	3·3	77
8 Do. 20 per cent ..	31·35	138·8	52·58	101·4	109·5	3·0	76
a-indole acetic acid—							
9 10 p.p.m.	26·86	118·9	45·78	88·3	102·1	3·0	74
10 20 p.p.m.	26·50	117·3	51·12	98·6	104·3	3·4	74
11 Control dry seed	22·59	100·0	51·86	100·0	98·8	3·6	77
12 Soaked for 24 hours before sowing in water.	21·00	93·0	52·74	101·7	101·3	3·0	76
13 Continuous illumination for fourteen days in conjunction with soaking in K_3PO_4 solution.	19·34	85·6	51·89	100·1	94·9	4·6	78
ether significant or not. ..	Very highly significant.		Yes.	Yes.	Yes.	Yes.	No.
tical difference at 5 per cent.	3·20	14·2	..	..	..	..	..
tical difference at 1 per cent	5·27	23·3	11·67	22·5%	8·1	0·6	..

(*b*) *Effect of soil.*

	gms.		gms.		cm.		days.
mplete soil (NPK)	25·78	..	54·02	..	100·3	3·6	76·5
-deficient soil NK	20·87	..	43·98	..	102·3	2·7	77·4
ether significant or not ..	Yes.	..	Yes.	..	Yes.	Yes.	No.
tical difference at 1 per cent level.	2·07 gms.	..	4·58 gms.	..	3·2 cm.	0·2	..

TABLE No. 46.—*Effect of pre-soaking paddy seed in phosphate solutions.*

(Field trial in the Paddy Breeding Station.)

1949 Season.
Sown—26th August 1949.
Transplanted—6th October 1949.
Harvested—28th February 1950.

Paddy variety—Co. 19.
Plot size—4 × 20 feet.
Planted—6″ × 6″ in doubles interspaced 1 fo
Layout—Three treatments replicated ei
times.

Replications.	Weight of grain in grammes treatment. (A) Soaked in K_3PO_4 —10 per cent.	(B) K_3PO_4 —20 per cent.	(C) Control.
	gms.	gms.	gms.
1	3,210	3,380	3,010
2	3,350	3,330	2,950
3	2,970	2,840	2,820
4	2,890	2,930	2,680
5	3,060	3,140	2,810
6	2,850	3,200	2,510
7	3,090	3,040	3,040
8	3,020	3,200	2,400
Total	24,440	25,060	22,220
Mean	3,055·0	3,132·5	2,777·5
	LB.	LB.	LB.
Acre yield in lb.	3,667	3,760	3,334
Critical defference = 1 per cent—267 lb.			
Percentage on control = 100	109·9	112·8	100·0
Critical difference 1 per cent level	222·7 gms.		
	8·02 per cent.		

Conclusion— B, A, C

N.B.—Straw weights were not recorded in this field trial.

TABLE No. 47.—*Effect of pre-soaking groundnut in phosphate solutions.*

Variety—AH. 25.
Treatments—
Replications—4 in glazed pots 10″ × 10″ holding 19 kilos of sand.

Sown—12th March 1949.
Harvested—7th July 1949.
Phosphate—deficient nutrient solution was supplied to all pots at 1 litre per pot—twice a week.

Treatments (particulars).	Dry weight. Gms. per pot.	Dry weight. Per centage on control.	Mean pod number.	Percentage on control.	Total weight of plant material. Gms. per pot.	Total weight of plant material. Percentage on control.	Plant height. cm.	Plant height. Perce
1 Soaked in 1/3 weight of seed of KH_2PO_4 solution at 2 per cent concentration and air-dried.	39·0	183·5	44·0	174·6	332·1	136·9	31·2	119·6
2 Soaked in 1/3 weight of seed of KH_2PO_4 5 per cent.	44·6	209·9	42·5	168·7	315·2	130·0	35·5	136·0
3 Soaked in 1/3 weight of seed of K_2HPO_4 —2 per cent.	9·3	43·5	22·5	89·3	207·7	85·7	21·6	82·8
4 Soaked in 1/3 weight of seed of K_3PO_4 —2 per cent.	17·9	84·2	25·2	100·0	226·0	93·2	25·0	95·8
5 Dry seed (control) ..	21·3	100·0	25·2	100·0	242·5	100·0	26·1	100·0
6 Soaked 24 hours in water and sown wet.	19·6	92·1	23·8	94·4	219·5	90·5	25·4	97·3
Whether significant or not.	Very highly significant.		Very highly significant.		Very highly significant.		Very highly significant.	
Critical difference at 5 per cent.	11·2	52·8	9·2	36·5	54·1	22·3	3·7	14·2
Critical difference at 1 per cent level.	15·5	73·0	12·7	50·4	74·8	30·8	5·2	19·9

TABLE No. 48.—*Effect of pre-soaking ragi in phosphate solutions.*

ariety—Co. 2. Sown on—7th September 1949.
reatments—12. Harvested—7th December 1949.
plications—4 in glazed pots 10″ × 10″ holding 18 kilos of soil.

Treatments (particulars).	Dry weight of Earheads. Mean.	Earheads. Percentage on control	Straw. Mean.	Straw. Percentage on control.
	gms.		gms.	
Seeds soaked in 10 per cent KH_2PO_4	22·78	112·8	96·53	82·5
,, 20 per cent ,,	21·78	107·9	119·28	101·9
,, 10 per cent K_2HPO_4	18·30	90·6	94·34	80·6
,, 20 per cent ,,	20·43	101·2	123·76	105·7
,, 10 per cent K_3PO_4	24·37	120·7	137·04	117·1
,, 20 per cent ,,	43·74*	216·8	173·37*	148·1
,, 10 per cent $CaHPO_4$	29·21*	144·7	133·32	113·9
,, 20 per cent ,,	24·60	121·9	126·22	107·8
,, 10 p.p.m. beta indole acetic acid	25·43	126·0	153·01	130·7
,, 20 p.p.m. ,,	31·53*	156·2	169·28	144·6
Dry seed (control)	20·18	100·0	117·01	100·0
Wet (soaked in water alone)	19·32	95·7	106·03	90·6
gnificant or not	Yes.		Yes.	
itical difference at 1 per cent level	8·36	41·4	42·48	35·5

Conclusion—

Earheads — 6, 10, 7, 9, 8, 5, 1, 2 4, 11, 12, 3.

Straw—6, 10, 9, 5, 7, 8, 4, 2 11, 12, 13.

* Significantly superior to control.

TABLE 49.—*Effect of pre-soaking ragi in phosphate solutions—Experiment II.*

ariety—Co. 2. Sown—10th February 1950.
reatments—12. Flowered—6th April 1950.
eplications—6 in glazed pots of 10″ × 10″ size, holding 18 kilos soil. Harvested—9th May 1950.

Treatments (particulars).	Earhead weight (gross)	Straw weight. (gross)	Plant height. (gross)	Tillers per 10 paints.	Mean flowering (duration). (days)
oaked in—					
1 10 per cent KH_2PO_4	54·5	268·7	75·1	11·7	54
2 20 per cent ,,	55·4	284·8	77·9	11·8	53
3 10 per cent K_2HPO_4	54·5	273·8	79·1	12·0	53
4 20 per cent ,,	47·1	240·5	77·3	12·0	55
5 10 per cent K_3PO_4	62·7	322·5	81·2	14·0	54
6 20 per cent ,,	69·6	366·0	86·3	17·3	55
7 10 per cent $CaHPO_4$	52·8	277·7	77·9	10·7	55
8 20 per cent ,,	55·9	286·3	78·3	12·5	55
9 10 p.p.m. indole acetic acid	59·8	317·2	82·5	12·2	55
10 20 ,,	57·9	298·0	81·2	12·5	55
11 Dry (control)	63·1	293·8	78·9	11·7	55
12 Wet (water only)	61·7	264·2	71·9	10·5	55
Whether significant or not	Yes.	Yes.	No.	Yes.	Yes.
Critical difference at 5 per cent level	7·03	39·5	..	2·2	1—4 days

TABLE No. 50.—*Effect of pre-soaking bengalgram in phosphate solutions.*

Sown—19th October 1949
Harvested—16th January 1950. } in pots.

(*N.B.*—Results are expressed as percentages of control in each case.)

Treatment.	Pot cultures.			Field experim
	Pod number.	Pod weight.	Shoot weight.	Pod weight.
	PER CENT.	PER CENT.		PER CENT.
Seeds soaked in—				
1 KH_2PO_4 2 per cent	100·0	105·4	171·4	
2 „ 5 per cent	123·7	127·0	216·2	
3 „ 10 per cent	115·8	189·2	138·1	93·0
4 „ 20 per cent	89·5	135·1	116·2	
5 K_2HPO_4 2 per cent	105·3	108·1	171·4	
6 „ 5 per cent	113·2	105·4	58·1	
7 „ 10 per cent	68·4	81·8	105·6	108·0
8 „ 20 per cent	113·2	145·9	97·1	
9 K_3PO_4 2 per cent	152·6	118·9	128·6	
10 „ 5 per cent	65·8	81·8	46·7	
11 „ 10 per cent	89·5	81·8	37·1	94·0
12 „ 20 per cent	92·1	118·9	78·1	
13 $CaHPO_4$ 2 per cent	97·4	167·6	178·1	
14 „ 5 per cent	92·1	100·0	113·3	
15 „ 10 per cent	110·5	154·0	175·2	78·0
16 „ 20 per cent	150·0	118·9	149·5	
17 Control	100·0	100·0	100·0	100·0

(*N.B.*—Statistical analysis not done as trial was a preliminary one.)

TABLE No. 51.—*Effect of pre-soaking cowpea in phosphate solutions.*

Variety—C. 57.
Sown—28th February 1949.
Treatments—12.
Harvested—18th July 1949.
Replications—4 in glazed pots of 10″ × 10″ size holding 19 kilos of sand.
Phosphate—deficient nutrient solution w applied at 1 litre per pot twice a week.

Treatments (particulars).	Plant height.		Fresh weight of shoot materials.		Dry weight of pods.		Mean numb
	Cms.	(*a*)	Gms.	(*a*)	Gms.	(*a*)	Per p
1 Soaked in 1/3 weight of seed of distilled water once and air-dried before sowing.	75·1	84·1	137·4	85·6	2·95	146·3	9·
2 Soaked in 1/3 weight of seed of distilled water twice.	65·3	73·1	129·0	80·3	4·52	220·5	12·
3 Soaked in 1/3 weight of seed of KH_2PO_4 10 per cent.	54·4	60·9	113·8	70·9	2·18	106·3	5·
4 Soaked in 1/3 weight of seed of KH_2PO_4 20 per cent.	60·1	67·3	101·0	62·8	1·35	60·5	4·
5 Soaked in 1/3 weight of seed K_2HPO_4 10 per cent.	70·9	79·4	92·4	57·5	1·78	86·8	6·
6 Soaked in 1/3 weight of seed K_2HPO_4 20 per cent.	78·0	87·3	107·1	66·7	2·63	128·3	8·
7 Soaked in 1/3 weight of seed of K_3PO_4 10 per cent.	81·4	91·1	107·0	66·6	1·33	64·9	4·
8 Soaked in 1/3 weight of seed of K_3PO_4 20 per cent.	104·7	117·2	144·6	90·0	2·99	141·4	6·
9 Soaked in 1/3 weight of seed of $CaHPO_4$ 10 per cent.	83·3	93·3	160·6	100·0	5·25	256·1	9·
10 Soaked in 1/3 weight of seed of $CaHPO_4$ 20 per cent.	197·7	221·4	146·5	91·2	6·33	308·8	11·
11 Dry (control)	89·3	100·0	160·6	100·0	2·05	100·0	4·
12 Wet (soaked 24 hours in distilled water and sown wet).	106·5	119·3	197·0	122·7	5·20	253·6	11·
Whether significant or not	Yes.	..	..	Yes.	..	Yes.	No.
Critical difference at 5 per cent.	..	..	37·1	23·1	2·86	134·6	..
Critical difference at 1 per cent.	13·8	21·1	61·4	38·2	3·76	18·74	..

(*a*) Percentage on control = 100.

TABLE No. 52.—*Effect of pre-soaking Blackgram in phosphate solutions.*

iety—Local from P.L.S. Sown—6th October 1949.
atments—6.
lications—4 in 10″ × 10″ glazed pots. Harvested—10th January 1950.

Treatments (particulars).	Weight of roots.	Weight of shoot.	Dry weight of pods.	Mean pod number.
	GMS.	GMS.	GMS.	
oaked in K_2PO_4 10 per cent	8·0	124·0	44·5	72·5
,, ,, 20 per cent	7·5	154·5	47·0	63·5
,, $CaHPO_4$ 10 per cent	4·5	139·5	50·5	79·3
,, ,, 20 per cent	7·0	149·0	49·5	76·2
ry (control)	8·5	198·5	49·5	93·8
oaked in water only	9·0	223·5	50·5	101·5
ether significant or not	No		No	

Conclusion—None of the treatments tried, appear to be beneficial in the case of blackgram.

TABLE No. 53.—*Hormone trials on second-crop potatoes at the Nanjanad Agricultural Research Station.*

out—Randomized plots of 0·5 cent lett area with 8 treatments replicated six imes. Planted—14th September 1949.

iety—Great Scot—at a seed rate of 2,500 lb. per acre. Harvested—17th January 1950.

Treatments (particulars).	Seed		Chats.		Rejects.	
	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
		PER CENT.		PER CENT.		PER CENT.
Control (untreated tubers)	1,300	100·0	1,410	100·0	450	100·0
Tubers soaked for 6 hours in indole cetic acid 10 p.p.m.	1,226	94·3	1,360	96·4	634	140·9
Tubers soaked for 6 hours in indole cetic acid 60 p.p.m.	1,560	120·0	1,490	105·7	610	135·6
Tubers soaked for 6 hours in indole cetic acid 100 p.p.m.	1,210	93·1	1,458	103·4	524	116·4
Tubers soaked for 6 hours in indole utyric acid 10 p.p.m.	1,476	113·6	1,510	107·1	624	138·7
Tubers soaked for 6 hours in indole utyric acid 60 p.p.m.	1,626	125·1	1,600	113·5	484	107·6
Tuber soaked for 6 hours in indole utyric acid 100 p.p.m.	1,726	132·8	1,444	102·4	544	120·9
Water only	1,434	110·3	1,434	101·7	534	118·9
ether significant or not	Yes.		No.		No.	
tical difference at 5 per cent level ..	338	25·9				

Conclusion—G, F, C, E, H, A, B, D.

(*a*) Lb. per acre. (*b*) Per cent on control.

TABLE NO. 54.—*Effect of vernalization on paddy varieties.*

(Summary of results of 1946 to 1949—expressed as mean percentage on control—100.)

Effects.			*Vernalisation treatment.*				*Remarks.*
Varieties.		*D.* 22.	*D.* 14.	*D.* 7.	*L.* 7.	*L.* 14.	
			(a) Effect on plant height.				
Adt.	3	..	103·7	105·5	102·9	101·1	(1) It may be concluded that t
PTB	10	..	98·5	94·7	89·6	92·7	the whole, plant height is n
Co.	21	..	93·3	97·8	100·7	94·2	improved very markedly as
GEB.	24	..	106·3	110·7	106·4	95·7	result of vernalisation trea
AKP.	5	..	101·3	100·8	100·2	100·5	ments although it is improv
AKP.	8	82·4	101·7	101·4	104·6	101·4	more often than reduced.
MTU.	7	..	100·8	102·1	102·9	102·2	(2) In AKP. 8.—Vernalisati for 22 reduced plant height nearly 20 per cent.
			(b) Effect on tillering.				
Adt.	3	..	113·5	101·2	95·6	94·5	(1) Two varieties, GEB. 24 a
PTB.	10	..	90·1	101·4	68·2	78·2	AKP. 8 show a definite improv
Co.	21	..	106·2	105·1	89·8	100·0	ment in tillering. It is not
GEB.	24	..	108·5	116·8	107·3	125·1	marked in AKP. 5, except und
AKP.	5	..	91·4	94·1	110·3	130·3	L. 14 treatment.
AKP.	8	85·5	105·5	105·5	112·5	137·4	(2) The three short duration var
MTU.	7	..	94·1	79·2	76·1	95·8	ties, Adt. 3, PTB. 10, Co. 21 a MTU. 7 do not show a improvement in tillering.
							(3) In the variety PTB. 10, till ing is uniformly depressed vernalisation.
			(c) Effect on flowering earliness.				
Adt	3	..	98·1	105·2	94·5	94·5	Except in AKP. 8 under 22 da
PTB.	10	..	98·9	100·0	96·9	96·4	dark day treatments, where t
Co.	21	..	97·1	96·6	97·2	97·0	flowering was hastened by nea
GEB.	24	..	97·2	96·9	96·8	93·9	20 per cent flowering respo
AKP.	5	..	98·3	99·9	98·8	95·4	sive was not improved by mo
AKP.	8	80·9	97·8	99·1	98·9	98·4	than 7 per cent in any varie
MTU.	7	..	101·0	97·9	97·6	98·7	by any of the vernalizati treatments tried in this series experiments.
			(d) Effect on grain yield.				
Adt.	3	..	95·5	80·8	80·6	122·1	(1) GEB. 24, AKP. 8, AKP. 5, a
PTB.	10	..	88·5	101·3	86·2	91·2	definitely responsive to verna
Co.	21	..	103·8	97·3	110·2	104·5	zation treatments in grain yie
GEB.	24	..	130·2	119·8	127·3	133·0	the increase ranging from 12
AKP.	5	..	113·9	119·5	118·5	118·9	38 per cent.
AKP.	8	79·0	137·9	124·5	125·6	114·5	(2) The three short duration v
MTU.	7	..	107·5	97·2	99·3	93·6	rieties Adt. 3, PTB. 10 and C 21 are not so responsive, exce Adt. 3, under L. 14 treatment.
							(3) MTU. 7 also does not show a definite improvement in gra yield as a result of verna sation.

TABLE NO: 54—*Effect of vernalization on paddy varieties.*

Effects.	*Vernalization treatment.*				*Remarks.*
rieties.	*D. 22.*	*D. 14.*	*D. 7.*	*L. 7.*	*L. 14.*	
			(e) Effect on straw yield.		
lt. 3	101·4	95·9	104·8	96·3	(1) General trend is similar to grain yield responses though less marked. Here too, GEB. 24 and AKP. 8 show a consistent increase over controls under different vernalization treatments. (2) In AKP. 5, the straw yield tends to be reduced by vernalisation, though the grain yield is increased. (3) MTU. 7 and the three short duration types Adt. 3, PTB. 10 and Co. 21 are not responsive.
TB. 10	95·3	113·3	81·3	107·2	
. 21	102·9	106·7	111·7	101·1	
EB. 24	107·3	110·9	110·7	108·2	
KP. 5	95·4	92·4	97·3	101·3	
KP. 8	133·7	119·7	116·1	103·3	
TU. 7	94·8	94·2	98·3	95·9	

NOTE.—D. 22—Seeds vernalised in total darkness for 22 days; D. 14—for 14 days; D. 7—7 days; L. 7—Vernalised in continuous illumination for 7 days; L. 14—Vernalised in continuous illumination for 14 days.

TABLE NO. 55.—*Effect of trace element on sprays on paddy soils.*

(Summary of results of 1947, 1948 and 1949 seasons.)

Treatments.	*Grain yield. (Expressed as a percentage of control=100 of each year.)*				*Straw yield. (Expressed as a percentage of control = 100 of each year.)*			
	1947.	1948.	1949.	*Mean.*	1947.	1948.	1949.	*Mean.*
Control	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Sprayed with $CUSO_4$ solution at 20 lb. per acre.	112·3	114·3	101·7	109·4	109·5	104·5	112·7	108·9
Sprayed with $ZnSO_4$ at 10 lb. per acre.	111·1	128·6	111·3	117·0	114·1	115·0	117·1	115·4
Sprayed with $MnSO_4$ at 10 lb. per acre.	119·0	123·8	107·8	116·9	107·5	111·8	102·2	107·2
Cu +Mn sulphates.	96·1	104·8	113·9	104·9	97·7	102'0	101·3	100·3
Cu+Mn+Zn sulphates.	123·6	120·6	98·4	114·2	102·7	112·0	93·8	102·8

TABLE NO. 56.—*Effect of Borax on sweet potato yields.*

d number	F. No. 61	F. No. 52-B ..	F. No. 61.
atments	4	4	4.
lications	6	6	6.
size	1·92 cents	1·5 cents	0·512 cents.
ax applied on	29th September 1947	30th October 1948.	27th July 1949.
ated on	29th October 1947.	30th November 1948.	3rd September 1949.
rvested in	....	2nd May 1949 ..	23rd January 1950.

Treatments.	1947–48.		1948–49.		1949–50.	
	Lb. per acre.	*Per cent on control.*	*Lb. per acre.*	*Per cent on control.*	*Lb. per acre.*	*Per cent on control.*
Control	7,500	100·0	4,811	100·0	14,258	100·0
10 lb. borax/acre ..	7,068	94·2	..	..	..	..
20 lb. Do. ..	7,630	101·9	..	..	14,388	100·2
30 lb. Do. ..	..	..	..	..	14,906	107·8
40 lb. Do. ..	9,349	124·7	5,900	122·6	15·235	107·9
80 lb. Do. ..	..	..	4,489	93·3	..	..
120 lb. Do. ..	..	..	3,644	75·7	..	..
ether significant or not.	No.	..	Yes.	..	No.	..

TABLE No. 57.—*Effect of Borax on lucerne yields.*

	1947–48.	1948–49.	1949–50.
Field number	F. No. 59-A	F. No. 59-A	F. No. 76-E.
Treatments	4	4	4.
Replications	5	6	6.
Plot size	....	....	....
Borax applied on	1st October 1947	30th October 1948.	11th June 1949.
Sown	30th October 1947.	30th November 1948.	5th August 1949.
First cutting on	16th January 1948.	8th March 1949	29th October 1949.
Final cutting on	22nd November 1948. (12th)	23rd September 1949. (8th)	4th June 1950. (8th)

Treatments.	*Lb. per acre.*	*Per cent.*	*Llb. per acre.*	*Per cent.*	*Lb. per acre.*	*Per cent.*
1 Control	66,197	100·0	66,333	100	70·103	1
2 10 lb. borax/acre	70,376	106·3	..	..	..	..
3 20 lb. Do.	67,410	101·8	..	..	70,127	100·0
4 30 lb. Do.	..	..	..	..	..	..
5 40 lb. Do.	70,363	106·3	66,133	99·7	75,740	108
6 80 lb. Do.	..	..	65,411	98·6	75,000	106
7 120 lb. Do.	..	..	68,644	103·4	..	..
Whether significant or not.	No.	..	Yes.	..	..	..
Critical difference 5 per cent level.	..	..	..	9·9 per cent.	..	..

TABLE No. 58.—*Samples reported.*

	Details.	*Number of samples.*
I.	A & D Block samples (wet lands)—	
	(i) Green manure plants	8
	(ii) Leaf, stem of plants	16
	(iii) Paddy grain straw and chaff	22
	(iv) Soils	60
II.	Local green manure plants—	
	(i) Leaves and stems	28
III.	Vizianagaram soils	72
IV.	Cyclone work, soils	66*
V.	1948–49, A & D Block soils	20
VI.	Siruguppa samples	476*
VII.	Wynaad samples	72*
VIII.	Seethambalpuram	48
	Total	888

* These samples were registered in the general analytical sample register.

TABLE No. 59.—*Bacteriological analysis of Siruguppa Soils.*

	Bacterial count.	No sugar.	Co2 production, per cent glucose.	Per cent of increase.
Pre-irrigation, 1939–40—				
Block III	694,000	4·3	7·4	72·1
Do. V	656,000	6·6	9·8	48·5
Do. VII	1,209,000	7·1	11·0	54·9
Do. VIII	571,000	11·6	11·2	Nil.
Post-irrigation, 1940–41—				
Block III	3,350,000	6·3	14·6	123·8
„ V	3,750,000	6·4	11·6	81·8
„ VII	3,640,000	16·5	16·0	Nil.
„ VIII	4,590,000	6·9	10·9	59·3
Post-irrigation, 1941–42—				
Block III	1,500,000	2·7	6·0	122·2
„ V	3,130,000	6·2	7·1	14·5
„ VII	7,250,000	5·5	9·1	65·5
„ VIII	6,550,000	8·6	12·3	43·0
1942–43—				
Block III	550,000	3·9	10·7	174·4
„ V	1,750,000	8·8	20·8	136·3
„ VII	660,000	24·0	16·0	Nil.
„ VIII	1,020,000	25·7	23·3	Nil.
1943–44—				
Block III	1,010,000	2·2	5·7	159·2
„ V	1,150,000	4·9	9·6	95·9
„ VII	550,000	8·8	11·9	35·2
„ VIII	1,550,000	9·8	10·5	7·1
1944–45—				
Block III	2,920,000	2·8	7·9	182·2
„ V	2,200,000	6·5	15·3	135·4
„ VII	1,650,000	11·6	17·7	51·2
„ VIII	2,430,000	18·9	17·1	Nil.
1945–46—				
Block III	1,750,000	5·3	15·7	196·2
„ V	2,375,000	21·8	28·7	31·6
„ VII	2,400,000	25·1	26·5	5·6
„ VIII	3,950,000	25·8	34·8	34·9
1946–47—				
Block III	1,320,000	2·89	10·72	271·00
„ V	1,905,000	12·83	18·50	44·20
„ VII	2,701,000	16·69	21·56	28·05
„ VIII	4,444,000	21·73	21·60	0·60
1947–48—				
Block III	270,000	4·29	11·01	156·38
„ V	670,000	13·15	16·76	27·45
„ VII	370,000	15·89	24·43	53·86
„ VIII	1,100,000	20·20	19·23	— 4·85

TABLE No. 60.—*Associated growth of pulses and cholam (experiment conducted at Vizianagaram).*

P = Pulse.
C = Cholam.

Acre yield in lb.

Treatments.	Redgram series.				Lab-lab series.				Blackgram series.				Green Gram Series.			
	Cholam.		Pulses.		Cholam.		Pulses.		Cholam.		Pulses.		Cholam.		Pulses.	
	Grain.	Straw.	Grain.	Busa.	Grain.	Straw.	Grain.	Busa.	Grain.	Straw.	Grain.	Busa.	Grain.	Straw.	Grain.	Busa.
Pure P	..	..	255	4,118	..	..	328	789	..	..	90	1,191	..	..	57	2,416
¾ P+¼ C	177	4,492	55	1,293	289	3,030	209	289	370	5,594	18	459	396	5,991	68	1,191
½ P+½C	204	6,059	87	1,702	260	2,689	253	374	323	6,808	15	319	417	7,966	39	511
¼ P+¾ C	251	5,957	47	953	283	3,336	120	257	447	9,292	6	138	319	8,782	23	270
Pure cholam ..	172	4,901	..	..	287	3,608	..	..	391	8,132	..	..	387	9,668	..	..

TABLE No. 61.—*Associate growth of pulses and cholam (Vizianagaram experiment)*—1949–50.

Serial number and description of soil.	Treatment number.	Surface soil.				Sub-soil.			
		Moisture.		Nitrogen.		Moisture.		Nitrogen.	
		(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
1 Blackgram series	1	1·22	1·42	0·045	0·040	2·13	1·93	0·039	0·039
2 Do.	2	1·41	1·54	0·036	0·042	2·63	1·91	0·044	0·036
3 Do.	3	1·43	1·42	0·039	0·041	2·70	1·86	0·043	0·035
4 Do.	4	1·25	1·40	0·031	0·038	2·17	1·58	0·034	0·028
5 Do.	5	1·65	1·44	0·037	0·042	2·79	1·70	0·048	0·030
6 Greengram series	1	1·46	1·61	0·041	0·046	2·20	1·61	0·037	0·033
7 Do.	2	1·37	1·32	0·047	0·052	2·47	1·57	0·039	0·031
8 Do.	3	1·44	1·44	0·042	0·048	2·18	1·61	0·039	0·036
9 Do.	4	1·45	1·61	0·046	0·047	2·23	..	0·037	..
10 Do.	5	1·46	1·53	0·049	0·044	2·14	..	0·039	..
11 Lab-lab series	1	1·15	1·04	0·031	0·032	2·81	..	0·049	..
12 Do.	2	1·38	1·05	0·034	0·028	2·51	..	0·043	..
13 Do.	3	1·17	1·25	0·041	0·041	2·78	..	0·041	..
14 Do.	4	1·87	0·99	0·042	0·036	2·96	..	0·046	..
15 Do.	5	1·67	1·06	0·043	0·033	2·46	..	0·039	..
16 Redgram series	1	1·52	1·23	0·036	0·035	3·32	..	0·045	..
17 Do.	2	1·23	1·05	0·038	0·033	2·26	..	0·043	..
18 Do.	3	1·14	1·07	0·032	0·038	2·41	..	0·038	..
19 Do.	4	1·24	1·17	0·039	0·034	2·51	..	0·042	..
20 Do.	5	1·78	1·10	0·034	0·034	3·15	..	0·043	..

Treatment 1 — Pure pulse.
2 — ¾ pulse plus ¼ cholam.
3 — ½ pulse plus ½ cholam.

(a) Before sowing. (b) After harvest.

TABLE NO.62.—*Cultures.*

Serial number and name.	Total for the year.
1 Berseem	10
2 Lucerne..	45
3 Soyabean	2
4 Pillipesara	8
5 Horse gram	5
6 Black gram	37
7 Groundnut	10
8 Sunnhemp	4
9 Wild indigo	8
10 Dhaincha	52
Total ..	181

TABLE No. 63.—*Strength of staff as on 30th June 1950.*

Name of service and post.	Number of sanctioned posts.	
	Permanent.	Temporary.
I. *Madras Agricultural Service.*		
Government Agricultural Chemist	1	..
Assistant Agricultural Chemists	3	..
Agricultural Bacteriologist	1	..
Soil Physicist	1	..
Plant Physiologist	..	1
Gazetted Assistant in Chemistry	..	1
Total	6	2
II. *Madras Agricultural Subordinate Service.*		
Upper Subordinates—		
Main Section	18	..
Tungabhadra Project	..	..
Teaching Section	..	1
Plant Physiology Scheme	..	1
Compost Scheme	..	2
Scheme for Improvement of Potatoes in Nanjanad	..	2
Cholam Effect Scheme	..	2
Control of Price and Quality of Manures	..	1
Total	19	9
Fieldmen—		
Cholam Effect Scheme at the Agricultural Research Station, Koilpatti.	..	1
Potato Scheme at the Agricultural Research Station, Nanjanad.	..	1
Total	..	2
III. *Madras General Subordinate Service.*		
Laboratory Attenders—		
Main Section	7	..
Teaching Section	..	2
Plant Physiology Scheme	..	1
Compost Scheme	..	1
Manure Scheme	..	1
Total	7	5
IV. *Madras Ministerial Service.*		
Upper Division Clerk—		
Compost Scheme	..	1
Lower Division Clerks—		
Main Section	3	..
Manure Scheme	..	1
Total	3	2
V. *Madras Inferior Service.*		
Peons—		
Main Section	7	..
Plant Physiology Scheme	..	2
Compost Scheme	..	1
Total	7	3

ADMINISTRATION REPORT OF THE GOVERNMENT ENTOMOLOGIST FOR THE YEAR 1949–50.

DETAILED REPORT.

I. General.

(*a*) *Charge.*—Sri S. Ramachandran, Government Entomologist, handed over charge to me on 14th June 1950 and proceeded on two months leave. I acted as Government Entomologist for the rest of the period.

(*b*) *Staff.*—Sri A. R. Seshadri, Assistant Entomologist, on closure of the Cardamom Scheme, joined duty at Coimbatore on 26th November 1949, reverting Sri S. Kanakaraj David to subordinate service. Sri S. Kanakaraj David, promoted to the Madras Agricultural Service as Gazetted Assistant in Entomology, Agricultural College, Bapatla, was relieved on 3rd June 1950. Consequent on the closure of the Trichogramma part of the Borer Pests Scheme, the headquarters of the Assistant Entomologist, Sugarcane Scheme, was shifted to Coimbatore with effect from 1st April 1950. Janab Md. Basheer, Assistant Entomologist in the scheme, joined duty at Coimbatore on 8th April 1950. Sri K. R. Nagaraja Rao, Assistant in Entomology, DDT Scheme, was taken over to the Main section with effect from 11th July 1949 in the vacancy of Sri N. Muthuswamy Naidu, whose services were lent to the Government of India, Food and Agricultural Department. Sri P. K. Vijayan, Assistant in Entomology, Orange Borer Scheme, joined duty on 12th August 1949. Sri S. Periasamy appointed as assistant, in a leave vacancy, joined duty on 14th September 1949 and was later transferred as Plant Quarantine Inspector, Shembaganur, on 12th December 1949. Sri K. C. Chandy, Assistant, was relieved on 29th October 1949 to join the post-graduate course at the Indian Agricultural Research Institute, New Delhi. Sri E. V. Abraham, Plant Quarantine Inspector, Mettupalayam was transferred to Coimbatore as Assistant in Entomology on 9th January 1950. He was temporarily transferred to Aduthurai and was later posted as Plant Protection Assistant (Entomology), Tanjore. Sri T. Santhanaraman was posted in the above vacancy at Aduthurai and he joined duty on 17th April 1950. Sri S. Kanakaraj David returning from leave joined as Assistant in the Sugarcane Scheme on 24th February 1950, and was subsequently taken over to the Main section with effect from 10th May 1950. Sri K. R. Nagarajan, on transfer from Nellikuppam, joined duty on 8th April 1950 as Assistant in the Sugarcane Scheme. R. Janakiraman joined as Fieldman on 8th September 1949 in an existing vacancy. Sri C. Sethumadhava Menon, Fieldman, was relieved on 21st April 1950 to join duty at the Cotton section and Sri K. Rajamani was taken in the vacancy. The services of Sri S. Rajagopal, Fieldman, were terminated on 28th February 1950 for want of a vacancy. Sri M. G. Rajavarma, Research Fellow was relieved on 9th July 1949, on the completion of his Fellowship.

(*c*) *Leave.*—Sri S. Ramachandran, Government Entomologist, proceeded on leave for two months with effect from 14th June 1950,

Messrs. S. Kanakaraj David, T. Santhanaraman, K. R. Nagaraja Rao, Mrs. A. Leela David, Assistants, were granted earned leave for various periods.

(*d*) *Tours.*—The Government Entomologist and staff were on tour for varying periods during the year, in connexion with the investigation of crop pests. The more important of them are (1) the red hairy caterpillar on cotton at Adoni (Bellary district), (2) the ber fruit fly at Panyam (Kurnool district), (3) the garlic thrips at Palladam (Coimbatore district), (4) the cigar beetle at Tiruchirappalli, (5) the striped bug of paddy at Kattuputhur (Tiruchirappalli district), (6) The mangojassids at Panyam (Kurnool district), (7) the orange borer at Wynaad, (8) the potato tuber moth, plum fruit fly, and Icerya purchasi on the Nilgiris and (9) the paddy stem borer, soorai and rats in Tanjore district. The Government Entomologist attended the Conference of Entomologists and Mycologists held under the auspices of the Indian Council of Agricultural Research at Patiala during March 1950, as a delegate of the Madras Agricultural Department.

(*e*) *Advisory.*—Numerous enquiries were received for help regarding the control of crop pests as well as on bee-keeping. Most of the items included under the latter category were attended to by the section while the others were transmitted to the Crop and Plant Protection Officers concerned.

(*f*) *Exhibitions.*—The section took part in some of the important exhibitions, such as (1) the All-India Khadi Swadeshi and Industrial Exhibition, Madras, (2) the Mysore Dasara Exhibition, (3) the All India Khadi and Swadeshi Exhibition, Coimbatore, (4) the Annual Flower Show, Ootacamund, a(5) and comprehensive exhibition arranged in connexion with the College Day and Conferenc at Coimbatore.

II. Research.

A. Investigations of crop pests.

The duties of the section being primarily to evolve suitable methods of control against insect pests of crops, full attention was bestowed towards the possibilities of adapting the two new wonder insecticid—BHC and DDT—for a field scale use. Tentative, but interesting, results were recorded during the previous year and one of the activities of the section for the year was the conduct of the confirmative tests on the previous findings with special reference to the comparative merits of the insecticides, their concentrations and dosages, residual as well as adverse effects, if any, etc. The results achieved have been highly helpful for the wholesale decimation of many a crop pest for which control measures evolved so far were neither efficient nor perfect. The utility of these chemicals has now passed the experimental stage for most of the pests and their large scale use is being vigorously popularised by the Plant Protection Organization.

(*a*) *Pests of paddy*—(1) *The paddy grasshopper* (*Hieroglyphus banian*).—The findings of the previous year were verified by field scale experiments in the Circars and Malabar, the variants used being BHC 5 per cent, Hexyclan 5 per cent and DDT 3 per cent. The results were identical in both the centres and in entire agreement with those already recorded. The BHC formulations caused almost a cent per cent mortality, commencing from 1½ hours after the application, while the action of DDT was delayed not to speak of its lower lethal effect. The most economical and efficient concentration was BHC dust 5 per cent. Small scale experiments with BHC 2, 3, 4 and 5 per cent; Toxaphene 10 per cent, sprays of DDT, BHC, DDT Emulsion, Parathion, etc., were also tried at different concentrations and the results confirmed the above findings.

(2) *The rice bug* (*Leptocorisa acuta, T*).—BHC 2 and 5 per cent Farmers' dust (BHC 5 per cent), Hexyclan 5 per cent (a BHC product) and DDT 3 per cent were tried on a field scale. BHC was quite effective even at its lower concentrations causing almost a cent per cent mortality, while DDT was practically inert.

(3) *The striped bug of paddy* (*Tetroda histeroides*).—The insect appeared in a pest form in parts of Tiruchirappalli district. Various forms of insecticides like BHC and DDT as dusts and sprays, Toxaphene 10 and 20 per cent, E. 605 (Parathion) spray, DDT emulsion, etc., were tried. Of these the Toxaphene dusts and the BHC spray at 0·1 per cent gave the highest mortality.

(4) *The black bug of paddy* (*Scotinophora lurida*).—This insect is usually a minor pest often found in association with the striped bug. BHC 5 per cent and 10 per cent dusts were tried and the higher concentration effected cent per cent kill in the course of 48 hours.

(5) *The paddy stem borer* (*Schoenobius incertellus*).—The observations on this pest were conduoted at the Agricultural Research Station, Aduthurai. Two light traps were working from July 1949 to June 1950 and maximum emergence of the moths were recorded from November onwards to March. There was also a certain amount of overlapping of the broods. Exploratory trials with DDT and BHC as sprays on the Thaladi crop were conducted. The seedlings were treated separately with aqueous suspensions of DDT and BHC at 1 and 2 per cent before planting and two more sprayings were given at intervals of a week after planting. The results were encouraging as the percentages of infestation were 16, 28, 2 and 1 in the case of DDT 0·1, 0·2 and BHC 0·1 and 0·2 as against 63 on the controls. The apparent variations noted in the earlier stages were subsequently nullified probably by the later emergences. The work will be continued on a field scale during the current season.

(6) *The paddy mealy bug* (*Ripersia oryzae*).—The pest some. times occurs in a serious form over wide areas in the Tanjore Delta.

The incidence was low during the year. Trials with BHC 0·1 per cent and 0·2 per cent and DDT 0·1 and 0·2 per cent as sprays in infested plots in the field and on potted plants did not give any conclusive results. Dusting with BHC and DDT on the field was equally futile against the bugs which are safely lodged inside the leaf sheaths.

(7) *The paddy Gall fly* (*Pachydiplosis oryzae*).—The light trap experiments were continued at Ungathur in West Godavari district. The number of flies which were attracted to these contrivances and the yield data were recorded. The peak emergence was noted to be during the middle of September and quite a large number of them were caught in the light traps. In general, the yield worked out to 8 to 10 bags per acre in the light trap area as against 4 to 6 in the control block. Preliminary trials with BHC D. 025 gave encouraging results.

(8) *Field rats* (*Gunomys kok, Millardia meltada, etc.*).—Observations on the habits and the evolution of proper control measures of these troublesome rodents constituted one of the main lines of research at the Agricultural Research Station, Aduthurai. As already determined the field species comprise of the mole rat—Gunomys kok and the grass rat—Millardia meltada. Occasional specimens of the Gerbil rat—Tatera cuvieri-were also met with. Of these, the mole rat is the most destructive damaging the crop in all its stages. Observations show that the breeding commences by September and continues at a very high level till the completion of harvest by February. Fumigation with calcium cyanide was discontinued because of its inherent defects and high cost of application. The main line of control was by the mechanical digging and catching as well as by bow traps. Intensive research was also pursued, side by side, towards the possibilities of using zinc phosphide as a poison bait. While there can be no second opinion regarding the efficacy of this chemical as a general rodenticide, further work is necessary to determine the species which has a special preference to this bait and to render the vehicle of the bait more attractive, when the natural food is available in plenty in the field. Research is on progress on these lines.

(*b*) *Pests of cholam and cumbu*—(1) *The cholam earhead bug* (*Calocoris angustatus*).—Earlier observations were confirmed. BHC dust 2 per cent was quite efficient but a high dosage of 40 lb. per acre was found necessary. Further attempts to economise the treatment showed that a 7 per cent dust applied at the rate of 15 lb. per acre affords spectacular relief. The lethal effects are evinced even within an hour after the application and the mortality is complete by about 24 hours. No reinfestation was noted for over ten days and this period of freedom is enough for the crop to get over the vulnerable stage.

(2) *The Deccan grasshopper* (*Colemania sphenarioides*).—This pest occurs in rythmic cycles once in seven or eight years

and the duration of each cycle extends to four or five years. The adults are characterised by the absence of wings. The hoppers and nymphs are polyphagous in their feeding habits and occur in their hordes on dry crops like tenai, cotton, cholam, etc. Of these the first mentioned suffers most on account of the special partiality the hoppers exhibit to the earheads. Initial trials with BHC 5 per cent had little or no effect during the previous year. The experiments were repeated during the current year, the variants being 5, 7 and 10 per cent BHC, Hexyclan 5 and 10 per cent and DDT 3 per cent. It was definitely evident that this species succumbs only to the higher concentration of BHC 7 to 10 per cent and that DDT has little or no action.

(3) *Gryllids on tenai* (*Gryllotalpa sp.*).—An inordinately heavy incidence of Gryllids on tenai was an unique and interesting experience during the year, near Coimbatore. This insect is nocturnal in its habits and has not so far been recorded as a serious pest, except for an occasional damage to germinating cotton and sometimes to cholam also. These crickets were noted to breed in the waste lands and attack the neighbouring crop of tenai in their hordes late in the evening. The crop was in ears and over 5 to 8 insects were found resting on each earhead with the result that the entire florets and tender grains were eaten away. DDT and BHC dusts (including Hexidole) ranging from 2 to 5 per cent were given a fair trial on a field scale and here again BHC 5 per cent was found to have a selective action, the mortality being almost complete.

(4) *The cholam shoot fly* (*Atherigona indica*).—The investigations were in progress at Siruguppa. Varieties like M. 35-1, S.M. 1, M. 31-2, and P.B.R. showed a certain degree of resistance while A.S. 2095 was more susceptible. Various control experiments were laid out at the Agricultural Research Station, Siruguppa. The infestation and the yield data were gathered. Flooding with or without fish oil soap gave increased yields. Plots manured with groundnut cake gave higher yields than the controls, the application of the manure probably compensating for the higher incidence of the fly.

(5) *The ragi leaf noctuid* (*Laphygma exigua*).—This caterpillar is polyphagous in its habits and feeds on crops such as ragi, lucerne, groundnut, etc. It was severe on the ragi nurseries round about Coimbatore. The affected plots were dusted with DDT and BHC at 2 per cent and 5 per cent in each case. The higher concentrations brought about a high mortality of 71 and 83 per cent respectively and these results were confirmed by further experimentation.

(c) *Pests of sugarcane* (*Argyria, Diatroea and Scirpophaga*).—Routine observations on the macro and micro climatic factors, borer incidence, alternate host plants, etc., were continued at Coimbatore. Biological control of the borers with the aid of

Trichogramma and various other methods like earthing up of young canes, spraying of BHC and DDT, etc., were done at Nellikuppam. The details are furnished under " Review of work done in schemes."

(*d*) *Pests of vegetables*—(1) *The Garlic thrips* (*Thrips tabaci*).—Considerable attention was paid to the perfection of the methods already evolved towards the control of these minute but highly destructive insects. Tentative results of the previous year indicated the superiority of BHC spray over DDT. Exhaustive field scale trials were again conducted with 0·05 per cent and 0·1 per cent sprays of these two chemicals. The results were spectacular in the case of BHC even at 0·05 per cent as the treatment caused almost a complete annihilation of the thrips population. Ordinarily, one round of the spray is enough but a second one may be necessary in cases of severe infestation. The elimination of the pest results in a better growth of the crop, which in its turn encourages a better development of the bulbs. The value of the yield saved was computed to be somewhere about Rs. 1,000 per acre, while the cost per treatment works out to only Rs. 16. The chemical is getting exceedingly popular in Palladam taluk in Coimbatore district where this crop is grown extensively. The same insecticide can also be used with advantage against the same species of thrips on onions also.

(2) *The potato tuber moth* (*Gnorimoschema operculella*).—These moths freely breed on the tubers in the field and infest the produce later in the godown. Application of dusts like BHC, DDT, pyrethrum, acorus, sulphur, tobacco, etc., have indicated the possibilities of controlling the borer in the store-room. Maiden attempts were made to test the efficacy of BHC and DDT sprays at 0·05 and 0·1 per cent concentration, respectively. The results were encouraging. The plots treated with BHC had little or no infestation while the damage was 9·5 per cent in the case of DDT as against 12·5 per cent in the controls. The experiments will be repeated on a large scale on the main crop in the ensuing season.

(3) *The Chillies thrips* (*Scirtothrips dorsalis*).—DDT, BHC and tobacco were tried at different strengths as dusts and sprays to assess their comparative merits and arrive at the optimum dose. BHC 5 per cent dust, spray at 0·05 per cent, and tobacco dust gave the best results, tobacco spray coming next in efficacy.

(4) *Aphids on lab lab* (*Aphis medicagenis*).—The approved remedy against this insect is tobacco but this commodity has, of late, become prohibitively costly. Attempts, therefore, were made to see whether this vegetable insecticide can be substituted by any of the synthetic chemicals. DDT, BHC, HETP and FORS were tried of which HETP showed immense possibilities. The others with the exception of DDT were fairly effective. Another preparation—Agrocide cotton dust—a mixture of BHC, DDT and sulphur was also given a fair trial. Applied in judicious doses not exceeding 15 lb. per acre, this combination was equally effective, but its use at higher dosages is fraught with phytocidal risks.

(5) The bhendai jassid (*Empoasca devastens*).—The specific action of DDT against this jassid was further confirmed.

(6) *The tomato fruit borer* (*Heliothis obsoleta*).—Fortnightly dustings with DDT 2 and 3 per cent, BHC 5 per cent and calcium arsenate were given with a view to gauge their relative effects on the incidence of the borer. All the treatments showed lower infestation than the controls, the lowest being in the case of DDT 5 per cent. The incidence was on the whole mild during the season and as such the experiments will be continued when there is a heavier infestation.

(7) *The moringa caterpillar* (*Eupterote mollifera*).—Pyrodust, agrocide cotton dust, BHC spray, pyrocolloid and G. 205 P. were applied on the gregarious masses of the caterpillars and of these pyrocolloid caused the highest mortality, BHC and pyrodust coming next.

(e) *Pests of fruits*—(1) *The orange borers.*—The borers concerned with the damage at Wynaad was established to be the Cerambycid-Chloridolum alcomene. Investigations on this borer were in progress under a special scheme of the Indian Council of Agricultural Research, and the details are furnished separately in this report.

(2) *Mango hoppers* (*Idiocerus species*).—Confirmatory tests were made at Panyam to gauge the comparative efficacy of FORS, DDT 2 per cent dust, DDT 5 per cent plus sulphur, sulphur dust alone and DDT 0·05 per cent spray. The mean percentages of reduction in population of hoppers were 90·9 in DDT plus sulphur, 89·2 in DDT 2 per cent, 81·26 in DDT 0·05 per cent spray, 57·9 in sulphur alone as against 3·9 in the control. All the treatments had effected a better setting of the fruits. The maximum yield was obtained from trees dusted with DDT 2 per cent. Considering the cost, percentage of mortality and the yield, DDT either as dust at 2 per cent or spray at 0·05 per cent appears to be promising.

(3) *The mango leaf webber* (*Orthaga exvinacea*) *and Sapota leaf webber* (*Nephopteryx eugraphella*).—BHC and DDT each at 0·1 and 0·05 per cent strengths were sprayed. About 95 per cent of the caterpillars were dislodged from their webbings in both the treatments and most of them died as a result of the contact with the insecticidal washes.

(4) *The ber-fruit fly* (*Carpomyia vesuviana*) *and the jujub caterpillar* (*Meridarches sp.*).—Of the two, flies are often capable of entirely ruining the prospects of the crop in the Kurnool district, where it is grown as a poor man's delicacy. Earlier trials with poisoned sprays, baits, ploughing up the soil, etc., gave little or no relief. Regular field scale experiments were, therefore, laid out in a garden at Panyam with the recent insecticides, the variants being sprays of BHC and DDT 0·1 and 0·2 per cent and MKE emulsion at 0·08 per cent and 0·16 per cent with appropriate controls. The operations were commenced by August when the fruits had begun to set and develop and continued till harvest at intervals of three

weeks. The results were assessed by examining random samples of the fruits, plucked from the trees for damage by the maggots and by the caterpillars. The aggregate average percentages of infestation for the season by Carpomyia was 5·4, 4·8, 3·5, 2·6, 5·1 and 5·0 and by Meridarches 4·8, 3·1, 2·4, 1·3, 5·1 and 4·1 per cent for DDT 0·1 and 0·2 per cent, BHC 0·1 and 0·2 per cent and MKE emulsion 0·08 and 0·16 per cent respectively. The control plots showed 9·4 per cent infestation by the fly and 7·8 per cent by Meridarches. The broad conclusions are that all these chemicals are capable of exerting a certain amount of control over both the pests and that the results of BHC are more promising. Further trials are necessary to confirm the results.

(5) *The red tree ant* (*Oecophylla smaragdina*).—These ants construct their peculiar nests on fruit trees like mango, guava, sapota, jack, etc., and render approach to the trees impossible by their vicious stings. Tests with DDT sprays at 0·1 per cent and BHC at 0·1 per cent, 0·05 per cent and 0·025 per cent showed that the BHC formulations cause a complete kill within 3 to 6 hours. No dead ants were found near about the trees sprayed with DDT but they were found to desert the trees, thereby indicating the deterrent action of the chemical.

(*f*) *Pests of fibre crops.*—(1) *The cotton jassid* (*Empoasca devastens*).—This jassid which is severe on bhendai flared up on an equally virulent form on cotton at the Cotton Breeding Station, Coimbatore and advantage was taken of this opportunity to conduct a few experiments on a field scale. Previous trials have indicated the futility of BHC against this species and the experiments were, therefore, restricted to the assessment of the comparative merits of DDT dusts at 2 and 5 per cent, sprays at 0·1 and 0·05 per cent and HETP spray at 0·001 per cent. The results of DDT were spectacular both against the adults and nymphs, the spray being cheaper. Another interesting feature is that HETP, a chemical which has of late come into prominence, proved equally efficacious against the jassid as well as aphids. The cost also is within the economic limits of the average ryot as it works out to only Rs. 7–8–9 per acre. It is proposed to give a fair trial to this chemical during the ensuing season.

(2) *The red-hairy caterpillar* (*Amsacta albistriga*).—This polyphagous pest, which is generally severe on dry crops, was also noted on an equally destructive form on cotton at Adoni. The more serious aspect was that the invading caterpillars devoured the sprouting seedlings of the valuable strains evolved at so much trouble, often necessitating the resowing of the crop, not to speak of the possible danger of losing the strains themselves. The Assistant Cotton Specialist had reported the remarkable efficacy of DDT emulsion against these caterpillars and experiments were, therefore, laid out to improve, if possible the 'Modus' of the treatment. Fourteen variants comprising of different concentrations of DDT and

BHC as sprays and dusts and MKE emulsion as spray only were tried. From an analysis of the data, BHC sprays at 0·05 and 0·1 per cent had the highest lethal effects, the percentage being over 60. The dusts were not convincing, when applied in the open field but have given some promise when strewn in the trenches where the caterpillars are trapped during their onward march from field to field. Further trials are contemplated with higher concentrations of the dust. Whatever might be the merits of the chemicals, they are not expected to replace the time-honoured method of hand picking, which is simple, cheap and suited to the local conditions. They may, however, be useful for saving valuable strains of plant material in the research stations where the cost should not be taken into consideration.

(3) *The cotton aphid* (*Aphis gossypii*).—The control of these aphids has, of late, developed into a major problem, since tobacco, which is the approved specific has now become too costly and difficult to procure. Formulations of the new chemical comprising of BHC and DDT dusts and sprays, FORS, HETP, agrocide cotton dusts, etc., were tried and their merits compared with those of tobacco decoction. BHC spray 0·1, the dust at 5 per cent and HETP spray 0·01 per cent proved to be equal in efficacy to tobacco decoction.

(4) *The cotton leaf roller* (*Sylepta derogata*).—This is a pest against which the chemical method of warfare has not so far proved to be successful. Trials with different formulations of DDT and BHC, agrocide cotton dust, pyrodust, etc., did not yield any convincing results though BHC indicated its efficacy against the young caterpillars.

(*g*) *Pests on green manure crops.*—(1) *The Sunnhemp hairy caterpillar* (*Utethesia pulchella*).—DDT and BHC dusts at 5 per cent recorded a high degree of mortality of caterpillars and the experiments have to be pursued to definitely assess their relative efficacy.

(2) *The daincha semilooper* (*Semiothesa pervolgata*).—DDT 3 per cent and BHC 5 per cent were tried against these caterpillars. Cent per cent mortality was noted in the case of DDT while it was only 64 per cent with BHC. The experiments will be repeated.

(3) *Capsids and flea beetles on sunnhemp* (*Ragmus importunitas and Longitarsus belgaumensis*).—BHC 3 and 5 per cent and DDT 5 per cent were tried against these pests and BHC dusts caused a higher mortality, 77 per cent in the case of the capsids and 100 per cent in flea beetles, while it was only 72 per cent and 84 per cent with DDT 5 per cent.

B. Poison baits.

This is practically an unexplored field under South Indian conditions. Laboratory trials were instituted against grasshoppers (*Orthacris and Chrotogonus*) and caterpillars of Prodenia sp. The recipe followed was 1 part of BHC 5 per cent, in 8 parts of bran

and the bait was rendered attractive by the addition of a few bits of chopped leaves and a little molasses. The results were not conclusive and it is proposed to continue the observations.

C. (1) *Adverse effects of BHC and DDT.*

The advent of the new chemicals, though a blessing by itself, is occasionally fraught with some undesirable consequences as well. A few glaring instances wherein the application of DDT was followed by an inordinate attack of mites was recorded in the case of castor, brinjal and bhendi. The chemical has no action against mites and repeated applications were definitely noted to encourage their multiplication. The obvious reason is that DDT, while exerting a control over the parasites and predators, leaves the mites severely alone. A similar case of a severe incidence of aphids on cotton as an aftermath of DDT spray was also recorded. Laboratory experiments are in progress to work out the cause of this phenomenon.

(2) *Toxicity and residual effects of DDT and BHC on different insect pests.*

(*a*) *Tingids on brinjals* (*Urentius echinus, D*).—BHC and DDT were applied as dusts and sprays individually on potted plants at 5 and 0·05 per cent concentrations, respectively. A known number of freshly collected bugs was introduced on each of the treated plants, and the controls and their progress watched. The dead specimens were removed every day and fresh batches of the bugs were introduced on alternate days and the observations continued till the effects of the chemicals were no longer perceptible. The mortality was as high as 90 per cent to start with, decreased steadily down to 50 per cent during the first fortnight and remained at the same level for about a week. The lethal effect was on the wane on the subsequent days and completely disappeared in another week. The results show that residual action persists for about a month under laboratory conditions. Between the two, the insecticidal action of DDT appears to linger on for about 3 weeks while that of BHC was shorter by about a week. There was no difference in the mortality caused by the two insecticides in the formulations tried against this insect. The work is in progress.

(*b*) *DDT and BHC against Prodenia litura and Euproctis fraterna on castor.*—Three sets of trials were conducted on caterpillars which were uniformly two weeks old. In one set, the caterpillars alone were treated and fed with untreated leaves. In the second set, the chemicals were applied to the foliage and healthy caterpillars introduced. In the third set, both the caterpillars and leaves were treated. The caterpillars began to die in about six hours in all the treated plots. DDT brought about a quicker mortality as spray at 0·1 and as dust at 5 per cent. The caterpillars in the ontrol developed normally. The results were somewhat erratic n the case of Euproctis and the trials will be repeated.

D. Viability of seeds treated with DDT and BHC.

Nine varieties of seed material, viz., paddy, groundnut, cholam, gingelly, begalgram, pillipesara, redgram, daincha and sunnhemp were treated with BHC and DDT 5 per cent at the rate of one pound per 100 pounds of seeds during November 1949. Samples were drawn once a month and their germinating capacity tested. Infestation by insects also was recored once a week. From the results obtained so far, there is not much difference in the percentage of germination between the treated and the control. As regards infestation by insects, control lots of cholam, paddy, gingelly, groundnut and bengalgram showed vigorous damage by their specific pests, like Calandra, Rhizopertha, Tribolium, Oryzaephilus and Bruchids. Adults of these species were also found dead in the treated lots which indicates the persistent lethal action of the chemicals. Bengalgram, redgram, pillipesara, daincha and sunnhemp did not show any infestation even in the controls.

E. Biological control—Research on beneficial insects and their utilization.

(1) *The coconut caterpillar—Nephantis serinopa.*—The parasites —*Perisierola nephantidis, Trichospilus pupivora* and *Microbracon species*—were in rearing throughout the year. Consignments were supplied to the different breeding stations for liberation as well as for further multiplication. The feasibility of the mass rearing of Microbracon species on Corcyra caterpillars has given us another weapon to contend with this serious pest.

(2) *The fluted scale* (*Icerya purchasi*).—In all, a total of 47,000 adults of Rodolia cardinalis were reared and liberated in the infested areas on the Nilgiris and at Kodaikanals. The details of work are given elsewhere in the report under "Scheme work".

(3) *The apple woolly aphis* (*Eriosoma lanigera*).—The pest was effectively kept under check by its specific parasite Aphelinus mali. Parasitised material was collected and kept inside cages so as to effect the reduction of pest and increase the parasite activity in the field by allowing them to escape from the cages. In the field, parasitisation was literally built up to 83·6 per cent by the sustained efforts. A certain amount of relief has also been afforded by the introduction of the aphid-resistant stocks of apples.

(4) *The egg parasite Trichogramma.*—The rearing of Trichogramma was systematized under laboratory conditions by a well regulated and assured supply of host material from the eggs of Corcyra cephalonica and the stock maintained to meet all demands. The parasites were produced primarily for the biological control work against the sugarcane borer *Argyria sticticraspis* and parasitised egg cards were regularly supplied to Nellikuppam. The assiduous colonization brought about a higher parasitisation and a proportionate reduction in the infestation. Large consignments of parasites were despatched for trials against potato tuber moth,

at the Agricultural Research station, Nanjanad, paddy leaf roller at Repalle and Ongole in Guntur district and the cholam stem bore at Hagari.

F. Bee keeping.

About 30 colonies of bees were maintained for the purpose of research. Due to the continued failure of the monsoons and the consequent unfavourable seasonal and pasturage conditions, the progress of the bees was very poor, the total yield of honey being only 39 lb. The following aspects of research were pursued :—

(1) *Swarming and its control.*—Swarming impulse was not much in evidence and as such the methods of swarm prevention already contemplated could not be put to test. Interchanging position of hives, shifting parent colony and the process of dequeening and requeening appear to be helpful but further work is necessary under more favourable conditions.

(2) *Selective breeding.*—One colony (No. 41) which yielded maximum quantity of honey was selected and three new queens were reared out. These are being kept as separate nuclei and their progress and behaviour watched.

(3) Studies on the longevity of queens were continued.

(4) Observations on the rate of egg-laying indicated a minimum of 162 per day in June and a maximum of 371 in January.

(5) *Improvement of hives.*—Efforts were made to study whether the population and honey yield of colonies could be increased by modifications in the hives and improving the accommodation. The colonies were housed in bigger types of hives with one and two queens and the same conditions were provided for the standard type also. The response was not satisfactory in all these cases mostly due to the unfavourable conditions. The experiments have therefore to be repeated under more favourable auspices.

(6) *Pasturage.*—Six more plants were recorded as new sources of pollen and nectar. They are (1) *Leucaena glauca* Benth, (2) *Ipomea staphylina* R.S., (3) *Capparis teylanica* linn, (4) *Aegle Marmelos* corr, and (5) *Capparis stylosa* D.C. and (6) *Cereus* sp.

(7) *Bee enemies.*—The reduvid bug—Acanthaspis siva—apredator of the Indian bee was under study. The nymphal period extends up to 180 days and the longevity of the adult to 106 days. Both adults and nymphs are endowed with a long lease of life and are highly destructive to honey bees during the cold weather.

(8) *Bee-keeping demonstration and propaganda.*—Practical aspects of bee-keeping were demonstrated and necessary details furnished to various departmental officers under training in Entomology. Students and teachers from a number of other institutions, students of the B.Sc.,(Ag.) course, pupil trainees of the basic training schools, Lady teachers undergoing training in home craft, men teachers undergoing practical training in Agriculture, and numerous other interested parties visited the apiary.

(9) Comb foundation sheets were in heavy demand and in all 215 pounds were supplied to Departmental officers as well as other States like Mysore, Bombay, etc.

G. Systematic work.

Intensive work on systematic collections was carried out during the year. Insect collections were sorted into the various orders rearranged and classified into families as far as possible. The lists of existing named specimens were being prepared. Detailed studies were undertaken by members of the staff on Thysanoptera, Lepidoptera, Cecidomyidæ, Tachinidæ, parasitic Hymenoptera, Aphidae, Coccidae and Acarina. Collections were made and preserved for systematic work. Review of literature on Thysanoptera was in progress under the scheme for establishment of schools of research. A total of 119 genera and 460 species were reviewed, during the period under report.

III. A. Teaching.

The following classes were conducted for the B.Sc. (Ag.) class—

	Lectures.	Practicals.
I Year	62	46
II Year	35	52

The terminal and the University examinations for the above classes were conducted. Sri K. P. Ananthanarayana Ayyar and Sri A. R. Seshadri served as the internal examiners for the II Year and I Year University examinations, respectively. Practical and theory classes were also conducted in Entomology for the benefit of the Horticultural diploma trainees.

B. Training.

The assistants of the Orange-borer scheme and of the Cardamom scheme were given a general training in Entomology. Sri B. S. Ramanathan, a private, party, acquainted himself with the subject for about a week. Messrs. K. Perumal, N. Pinagapani, R. Jayaram, G. Selvarangaraju, I. Gnanavaram and P. Bharathan, Upper subordinates, undergoing training in Entomology were relieved on 31st August 1949 after the completion of the course. One fieldman and one maistri from Salem were trained in the biological control work for about 3 weeks and another fieldman from South Kanara in bee-keeping. Sri Parameswaram Pillai, a research student from Travancore University, was in the section for 15 days to acquaint himself with the technique of studying insects under controlled humidity and temperature conditions. He was also given the facilities to refer to the concerned literature.

IV. Review of Work under Special Schemes.

A. Grow More Food Schemes.

1. *Plant protection scheme.*—On the Entomological side, the plant protection work in the Presidency continued to be in charge of two officers—One stationed at Bapatla for the north and the other at Coimbatore for the southern zone. Each district was provided with a plant protection assistant. There was an addition of one messenger to each plant protection assistant from April 1950 onwards.

Season.—In the south, the seasonal conditions were very abnormal. The failure of the north-east monsoon resulted in the drying up of all irrigation sources. Droughty conditions prevailed practically in all the districts. The weather started well in the nothern zone with favourable rains during June and July. Later on there was a period of drought and the mungari crops were affected to a little extent. The north-east monsoon was very heavy. A severe cyclone hit the coastal districts from South Visakhapatnam to Guntur resulting in loss to crops. After December, dry weather prevailed almost till the end of May when a depression in the Bay of Bengal brought about precipitation of rain benefiting the standing crops and enabling preparatory cultivation in some areas. This rain also mitigated the summer that was getting severe. Regular break of south-west monsoon for 1950 season was however delayed till the end of June.

Equipment.—Two Almans midget Power dusters, one Orient rotary duster, 35 dobins rotary dusters, 250 bellows hand dusters and 50 packing boxes for the transport of dusters were added to the existing equipment in the northern region.

Plant protection work.—The main attention of the plant protection organization was focussed on the control of the pests of food crops, while those on other crops also were attended to as far as possible. A gist of the work done is furnished in the tabular statement given as Appendix 1.

Bee-keeping.—Is one of the items popularized by the department under special scheme sanctioned in G.O. Ms. No. 1139, Food and Agriculture, dated 10th June 1950. Twenty-seven special maistris were appointed to help those interested in Apiculture under the guidance of plant protection assistants in the coastal districts in the Northern zone. As a result bee-keeping was taken up by many as an interesting hobby.

Parasite breeding.—Three laboratories were established at Salem for the southern and at Razole and Narasapur for the northern zones, under the technical control of the respective Plant Protection Officers for the mass rearing and liberation of parasites to control Nephantis. This serious pest of coconut is kept in check by a number of parasitic wasps, which attack the pest in all stages. Of these the *Braconid-Microbracon serinopa* the Elasmid—*Elasmus nephantidis* and the Bethylid—*Perisierola nephantidis* are larval

parasites and Eulophid—*Trichosphilus pupivora* is a pupal one. The larval parasites were successfully reared on the caterpillars of *Corcyra cephalonica*. In the circars some difficulty was experienced in the rearing of the Eulophid pupal parasites during the summer months as these did not thrive well at the high temperatures prevailing then. An efficient and cheap contrivance for cooling the rearing cages was devised by the Crop and Plant Protection Officer, Entomology, Bapatla. With this devise, the parasite rearing was kept up even in the summer months and a large number of them were reared and released in the infested areas without importing from other localities as before. In all 120,000 parasites from the laboratory at Salem and 127,809 from Narasapur and 96,000 from Razole were released during the year.

2. *Civil Supplies Storage Scheme.*—With the object of watching the condition of the foodgrains imported and stored by the Government and to look after the proper preservation of the same against the damage by insects, rodents, etc., four regional Assistant Entomologists were continued to be stationed at Madras, Tiruchirappalli, Coimbatore and Visakhapatnam as headquarters. They continued to work under the technical guidance of the Government Entomologist and handled enormous quantities of grains and other allied stuffs with the help of their subordinate district staff. As a result of their valuable efforts, enormous quantities were preserved and made available for the country. The volume of material handled by each of the Assistant Entomologists is furnished in the statement given below :—

Place.	*Stocks examined at port in bags.*	*Stocks inspected in bags.*	*Stocks reconditioned in bags.*	*Stocks fumigated in bags.*
(1)	(2)	(3)	(4)	(5)
Coimbatore	1,14,227	4,734,337	288,906	67,819
Madras	90.692	362,955	70,822	73,489
Tiruchirappally ..	..	3,824,495	31,704	11,019
Vijayavada	..	1,043,136	..	12,069

Place.	*Stocks disinfested in bags.*	*Godowns disinfested in square feet.*	*Priority of stock releases in bags.*
(1)	(2)	(3)	(4)
Coimbatore	620,773	98,300	361,368
Madras	723,090	139,026	395,350
Tiruchirappalli	1,109,450	..	400,379
Vijayavada	..	146,670	..

B. Other schemes.

(i) *Sugarcane Borer Pests Scheme (Indian Central Sugarcane Committee Scheme).*—An intensive programme of research was followed towards the study of the borer pests of sugarcane with reference to their incidence, nature and extent of damage, influence of the weather factors on the borer population, alternate host

plants, natural enemies of the borers, varietal resistance, etc., on varieties Co. 413, 419 and 421 at Coimbatore. A gist of the results is given below.

General habits and the biology of the borers.—The observations were pursued on the same lines as in previous years. The borers concerned are (i) the early shoot borer—*Argyria* (Proceros) *sticticraspis* Hmp, (ii) the cane borer *Diatroea* (Proceros) *venosata* wlk, (iii) the top shoot borer (Scirpophaga sp.). Of these, Argyria infests the crop from the very germination and continues its activities till about July after which it slowly tails off. The caterpillars bore into the young tillers, killing them outright. The tentative indications of the influence of meteorological factors are that high temperatures, low humidities and a few sharp showers during the summer months are conducive for its multiplication. *Diatroea* (*Proceros*) *venosata*.—This borer is first seen by July and its virulence goes on steadily increasing till harvest. As the pest appears only after the canes are formed it does not affect the life of the plant though it causes a deterioration in the quality and quantity of the juice of infected canes. Low temperatures, high humidities and a light rainfall appear to be conducive for the prolific multiplication of this pest. Another aspect of the investigations was the mortality and compensation studies. The emergence of the mother plants as well as the tillers, their mortality, if any due to the borers and other causes, the subsequent compensation along with the actual loss in yield caused by borers, etc., were carefully investigated. The voluminous data concerning these are being sent to the Sugarcane Specialist, Bihar, for statistical analysis and evaluation of results. A gist of the findings is that Co's 413, 419 and 421 produced 6·7, 4·1 and 5·4 tillers per mother plant respectively. Out of these 4·2, 2·3 and 2·9 died due to various causes, leaving a balance of 2·5, 1·8 and 2·5 which developed into mature canes.

From the experience gained so far, Co. 419 gives indications of being more susceptible to the borers but the susceptibility may after all be more apparent than real since this variety has a low tillering capacity. Microclimatic observations were also recorded for the three varieties but no appreciable variations were noticeable. A number of wild grasses collected from the near vicinity of the sugarcane areas were examined to see whether they harbour any of the borers. Argyria, Diatroea and Scirpophaga were noted to breed on *Saccharum spontaneum*, but in insignificant numbers. The results of the observations are not very helpful in the control of the borers since they were found both on the sugarcane as well as on the wild plants at about the same period. No new parasites were observed.

Control measures.—Experiments on the possibilities of biological control of Argyria with the help of the egg parasite, Trichogramma formed a separate aspect of the scheme. Intensive colonization of the egg parasite was continued in the estate of the

East India Distilleries and the Sugar Factories, Limited, Nellikuppam (South Arcot district). The parasites were bred at Coimbatore and the parasitised egg cards despatched by post. The parasites on emergence were released in plots laid out according to the technical programme of the scheme. The liberations were commenced when the crop was about a month old and continued at weekly intervals at 16,000 parasites per acre per release. Fortnightly counts of the egg population, degree of parasitisation, borer population and infestation were recorded to assess the effect of the parasite releases in these plots. The data show that Argyria and Diatroea are the two major pests of this tract of which the former is more important. Trichogramma prefers the eggs of Argyria and Telenomus was more specific on Diatroea.

The releases of the parasites augmented the natural parasitisation in the field to an appreciable degree. As a consequence the colonized plots showed a lower borer population and infestation. But the yield of the treated plots was lower than the controls.

The Trichogramma part of the scheme was wound up on 31st March 1950 and the borer pest studies are being continued at Coimbatore.

Other control experiments.—(1) Earthing up the young canes against Argyria was continued during the year. The treated plots showed a decrease in the number of deadhearts and gave an additional yield of 1·77 tons per acre, over the controls but the data in either case were not statistically significant. The labour charges for all the three earthings per acre came to Rs. 5–13–0.

(2) *Influence of digging out cane versus cutting at ground level.*—Crop residues consisting of the under-ground portions of the cane when dug out gave an additional yield of 2·95 tons per acre. This method though indicative of higher yield has a few limitations like its impracticability in clayey soils, the dearth of labour during the rush of the harvest, etc.

(3) *DDT and BHC spraying trials.*—Spraying trials with 0·25 per cent strength of DDT and BHC for the control of stem-borers were conducted. Four sprayings at intervals of a month were given beginning from about a month after planting. The variations between the treatments were found significant and there was an increase in yield of 3·5 tons per acre in the treated plots over control but these results cannot be taken as final and conclusive.

(ii) *Rodolia Breeding Scheme* (*Post-war Development Scheme*).—Breeding and liberation of the imported predator beetle—*Rodolia cardinalis* muls. were continued on a large scale for the control of the fluted scale—*Icerya purchasi* on the Nilgiris and Kodaikanal. About 47,000 beetles were reared in the two laboratories and of these 26,900 were liberated on the Nilgiris and 20,100 in the Kodaikanal region. Localities infested as well as likely to be infested were regularly surveyed and symptoms of increase of fresh start

of the scale were promptly dealt with by liberating adequate numbers of the beetles. Rodolia roseipennis was the only indigenous natural enemy of some importance. Other species Rodolia netara from Travancore, Rodolia amabilis and Rodolia fumida from Mysore and Rodolia breviscula from Coorg were tried at Fernhill but were not found to thrive satisfactorily under the local conditions. A total of 1,220 of Rodolia cardinalis adults was despatched to the Entomologist, Fluted Scale Control Scheme, Bangalore.

Plant quarantine work was in progress both on the Nilgiris and Kodaikanal regions to prevent the inadvertent spread of Icerya to other parts of the country along with the plant material. Over 874 tons of wattle bark and several consignments of various notified plants were intercepted in transit, fumigated and passed. A number of consignments was also confiscated.

(iii) *Orange Borer Scheme* (*Indian Council of Agricultural Research*).—A scheme was sanctioned for a period of three years (financed by the Indian Council of Agricultural Research) and was initiated on 12th August 1949 with the object of investigating the nature and extent of damage by the Cerambycid borers on oranges in the Wynaad tract and devise suitable remedial measures. A general survey of the incidence of the pest was completed and interesting information on the activity of the borer gathered. The pest was prevalent throughout the tract and entire estates were infested in some cases. According to previous records, *Chelidonium cinctum* was reported as the major pest in parts of Mysore, Coorg, etc., but the findings at Wynaad go to show that another species (*Chloridolum alcmene*), occurs exclusively in this region. The other beetle (*Oberia mangal orensis*) was found to infest the seedlings and side shoots. All citrus varieties are attacked but pomeloes *Citrus grandis*-showed the least infestation. Intensity of attack was more in neglected gardens round about Manantoddy. The borer appears to have a long life cycle extending for about a year. The activity is in evidence from August onwards as indicated by the presence of considerable quantities of the chewed fibrous material thrown out from the boreholes. The pupal stages are met with by May and the adults generally emerge with the onset of the south-west monsoon by June.

V. Miscellaneous.

A. Fumigation.

1. A mild infestation by Lasioderma serricorne was controlled by fumigation with Killoptera at a cigar and tobacco factory at Thiruchirappalli.

2. Large consignments of cholam, cumbu, paddy, etc., were fumigated with calcium cyanide at the different breeding stations, Central Farm and Malt factory.

3. Samples of seeds of various kinds such as paddy, cotton, pulses, cashew, groundnut, cholam, pillipesara, grasses, bengalgram, etc., were also fumigated for despatch to foreign countries and the necessary Phytosanitary certificates issued.

4. Disinfestation of store rooms and godowns was also carried out at Cotton station, Millets station, Paddy station, Malt factory, and the Central Farm whenever required.

B. Visitors.

The Hon'ble Premier and the Minister for Agriculture, Government of Madras, visited the section and evinced keen interest in its activities. The Scientific Expert Committee appointed by the Government to review the progress of research in the department scrutinized the work of the section. Other distinguished visitors were Rao Bahadur Y. Ramachandra Rao, retired Locust Entomologist, Members of the Madras University Commission, the Hon'ble Sri T. Mariappa, Home Minister, Mysore State, and Sir A. Lakshmanaswamy Mudaliyar, Vice-Chancellor, University of Madras. Dr. E. S. Narayanan, Head of the Division of Entomology, New Delhi, was on tour to Coimbatore in connection with the preparation of a comprehensive review of the progress of Entomological research in India during the past five years. He was given the necessary help and co-operation in the matter. Sri K. Venkatasami Naidu and the Collector of Coimbatore, Honorary visitors, visited and gave their valuable suggestions and opinions regarding the future work of the section. The following batches of students also visited the section :—

(1) The Forest College, Coimbatore ; (2) the Municipal High School, Cannanore ; (3) Maharaja's College, Ernakulam ; (4) Pupil-teachers from the Basic Training School, Palayad ; (5) the Presidency College, Madras ; (6) the Forest College, Mysore ; and (7) the Municipal High School, Karur.

C. Publications.

The following papers were prepared and submitted for publication during the year :—

Series—"Some experiences with BHC. & DDT."

1. The Redhairy Caterpillar (*Amsacta albistriga*) : By Sri S. Ramachandran.
2. The Paddy Jassid (*Nephotettix bipunctatus*) : By Sri S. Ramachandran.
3. The Paddy Grasshopper (*Hieroglyphus banian*) : By Sri S. Ramachandran and Sri S. Kanakaraj David.
4. The Garlic and Onion Thrips (*Thirps tabaci*) : By Sri S. Ramachandran.
5. The Cotton Jassid (*Empoasca devastens*) : By Sri S. Ramachandran, Sri T. R. Subramaniam and Sri T. S. Muthukrishnan.

6. Indigenus Insecticides—Published in "Chemical age": By Sri S. Ramachandran.
7. Insect Pests and Their Control—A paper read before the Tamil Conference: By Sri S. Ramachandran.
8. Transmission of Research—A paper read during the College Day and Conference—1949: By Sri S. Ramachandran.

A Number of Popular Articles were also submitted for the Departmental Journal—"Mezhichelvam".

V. TIRUMALA RAO,
Acting Government Entomologist.

Note.—The following details are included under separate appendices.

Appendix II—Practical utility of the years achievements under research, items wherein positive achievements are not available, etc. (as called for in Director of Agriculture's No. X. 3-533-50, dated 9th May 1950).

Appendix III—Programme of work for 1950–51.

Appendix IV—Statement showing the number of sanctioned posts of officers and staff.

APPENDIX I.

Statement showing the plant protection work done in the Province during 1949–50.

Serial number and crop.	Pest.	Savings.		
		Area treated (in acres).	Money value.	Yield in tons.
(1)	(2)	(3)	(4)	(5)
1 Paddy	(i) Spodoptera (Army worm).	6,524·0	..	3,183·5*
	(ii) Thrips	14·0	..	..
	(iii) Paddy bug	516·0	..	46·0
	(iv) Hispa	32·0	..	5·0†
	(v) Stem borer	845·6	..	1,190·0
	(vi) Gall fly	300·0	..	56·0
	(vii) Mealy bug	330·0	..	220·0‡
	(viii) Paddy jassid	1,743·5	..	158·5
	(ix) Nymphula	1,607·5	..	669·1
	(x) Tetroda	517·0	..	345·0
	(xi) Grasshoppers (Surface, *Heiroglyphus, O. velox*	3,944·7	..	488·0
	(xii) Leaf folder	53·0	..	18·0
	(xiii) Root grubs	2,200·0	..	200·0
	(xiv) Rat	19,167·0	..	2,203·0
	(xv) Other pests	639·0	..	86·5
2 Cholam	(i) Stem borer	80·0	..	8·0
	(ii) Flea beetle	146·0	..	13·0
	(iii) Mite	49·0	..	3·5
	(iv) Earhead bug	263·0	..	23 0
	(v) Others	5·0	..	0·5
3 Cumbu	(i) Grasshopper	1,867·0	..	2,004·0
	(ii) Flea beetle	25·0	..	2·3
4 Ragi	(i) Laphygma	317·0	..	82·5§
	(ii) Aeolopus	65·0	..	5·0
	(iii) Root aphis	7·0	..	0·5
	(iv) Flea beetle	7·0	..	0·5
	(v) Thrips	61·5	..	6·5

* Figure for north zone only given.
† Only for south zone.
‡ Only for north.
§ South zone only.

Serial number and crop.	Pest.	Savings.		
		Area treated (in acres).	Money value.	Yields in tons.
(1)	(2)	(3)	(4)	(5)
			RS.	
5 Other millets ..	Deccan grasshopper ..	81·2	..	18·0
6 Wheat	Rat	5·3	..	..
7 Sugarcane ..	(i) Grasshopper ..	14·5	1,450	..
	(ii) Borer (*argyria*).	13·0	1,040	..
	(iii) Termites ..	47·0	33,000	..
8 Pulses	(i) Heliothes sp. ..	24·0	1,200	..
	(ii) Azazia sp. ..	40·0	2,000	..
	(iii) Aphis	7·0	..	..
	(iv) Rats	114·0	1,400	..
9 Cotton	(i) Jassids	63·0	..	..
	(ii) Bollworms ..	29·0	..	..
	(iii) Thrips and aphis	22·0	2,900	..
	(iv) Mites	5·0	..	..
	(v) Dusky cotton bug.	5·0	1,080	..
10 Oilseeds ..	Plant lice	50·0	1,000	2
Groundnut ..	Leaf miner	190·0	..	10
Gingelly ..	Leaf catterpillar and Pod borer.	66·0	1,300	2
	Pentatomid	3·0	..	¼
	Rat	13·0	..	¼
Castor	Semilooper	10·5	1,300	..
Coconut ..	Rhinoceros beetle ..	3,225 trees	3,225	..
	Nephantis	7,725 ,,	36,325	..
	Palm weevil	15 ,,	..	..
	Termites	60 ,,	..	..
	Rats	30 ,,	..	..
11 Fruits	Mango, citrus, pomegranate, etc.	40,942 trees	52,980	..
	Grape flea beetles ..	110 vines	5,500	..
12 Vegetables ..		1,870	2,07,430	351
	Rats	5,176	7,888	..
	Onions-thrips ..	451	1,45,150	..
	Chillies-thrips ..	7,393	4,67,510	..
	Termites	5	140	..
13 Others	Betel-vine bug ..	2	750	..
	Tobacco—Prodenia ..	130	7,54,000	..
	Aphis	107	14,500	..
	Jasmine—Thrips ..	5	200	..
	Stored product, seeds, etc.	7,035 bags.	7,400	..

APPENDIX II.

Summary of Practical Results achieved during 1949–50.

Introduction.—The outstanding achievements during the period under report comprise of the adaptation of the two new chemicals—BHC and DDT—for the control of pests on a wide scale. The remarkable efficacy of these insecticides has led almost to the replacing of all the other time-honoured methods of control which were mostly of a mechanical nature. The following is a resume of work crop-war.

Food crops—(1) *Cereals—Paddy.*—Large scale field trials in the Circars and Malabar established the specific action of BHC D·025 against the paddy grasshopper (*Hieroglyphus banian*). The same chemical was equally effective against the rice bug (*Leptocorisa acuta*) and the lesser grasshopper of paddy (*Oxya velox*).

The striped bug of paddy (*Tetroda histerides*) and the black bug of paddy (*Scotinophora lurida*) required a higher concentration (BHC 10 per cent). The chemical has gained rapid popularity among the ryots. A continuous use of light trap once again attracted a number of the paddy gall flies (*Pachydiplosis oryzae*) and the yield was higher in the light trap area as compared with that of control. The use of the rodenticide (*Zinc phosphide*) against the field rats is being popularized.

Millets.—BHC 7 per cent was found very effective against the cholam earhead bug (*Calocoris angustatus*) even at a very low dosage as 15 lb. per acre. Another major pest which is a regular visitor to the Ceded districts is the notorious Deccan grasshopper (*Colemania sphenarioides*). The existing methods of netting, use of hopper dozers, etc., having had little or no effect on the pest, the new chemicals were given a fair trial. BHC 7 per cent to 10 per cent was found to have a high lethal action against these hoppers. The millets grasshopper (*Heiroglyphus nigrorepletus*) which is very bad in parts of Cuddapah district was exterminated by the use of BHC D·025.

(2) *Vegetables.*—During the course of confirmatory trials the specific actions of BHC D·025 against the chillies thrips (*Scirtothrips dorsalis*), BHC spray at 0·05 per cent concentration against the garlic and onion thrips (*Thrips tabaci*), DDT spray against the cotton jassid (*Empoasca devastens*), etc., were established.

(3) *Fruits.*—Some of the major pests which received attention were (1) the ber fruit fly (*Carpomyia vesuviana*); (2) the mangohopper (*Idiocerus sp.*); (3) the red tree ant (*Oecophylla smaragdina*). Large scale field trials against the first mentioned insect were conducted at Panyam, Kurnool district, and the superiority of BHC spray was found out. Practically there was no infestation in the treated garden, while every other fruit examined from a neighbouring untreated garden was found infested. DDT spray even at 0·05 per cent was quite effective against the mangohopper and the cost of treatment worked out to Re. 0–8–3 per tree. BHC spray even at a very low concentration (0·025 per cent) was highly lethal to the red tree ants. The cottony cushion scale (*Icerya purchasi*) and the apple wooly aphis (*Eriosoma lanigera*) were successfully kept in check by biological methods of control.

Industrial crops.—The egg parasite (*Trichogramma*) gave uniformly encouraging results against the early shoot borer of sugarcane (*Argyria sticticraspis*). The biological method of control against the coconut caterpillar (*Nephantis serinopa*) was pursued and one of the latest finding is that the parasite Microbracon serinopa can be successfully reared under laboratory conditions having Corcyra caterpillars as the host material.

Besides these, research on fundamental aspects of Entomology such as bionomics, life histories, systematics, etc., was continued. The preparation of a review on Braconidae was completed while the one on Thysanoptera is under progress.

Dissemination of research.

The control measures evolved by the section were popularized through the Plant Protection Organization. The Entomological staff under the control of the Civil Supplies Department continued to render valuable help in the conservation of foodgrains against the ravages of insects during these days of acute food scarcity. Beekeeping is another aspect which attracted considerable attention and the needs of various people interested in the subject were promptly attended to. The demand for the comb foundation sheets has considerably increased and this institute is serving as centre for supply to some of the other States like Mysore and Bombay.

Items wherein no positive achievements are available so far.

Though the methods of insect control have been completely revolutionized by the advent of the two new chemicals—DDT and BHC—which have proved to be almost a panacea for insects feeding on the plants from outside, the problem of the control of the *borers* remains still unsolved. Work was, therefore, concentrated on the control of the borers by making use of these new chemicals—(1) investigations were in progress at the Agricultural Research Station, Aduthurai, on the control of the paddy stem-borer *Schoenobius incertellus* by the application of DDT and BHC on the seedlings at the critical time of the mass emergence of the moths; (2) observations on the influence of the weather factors on the infestation of sugarcane borers were continued; (3) A scheme for the intensive study on the control of orange borers (*Chelidoimum cinctum* and *Choridolum alcmene*) was initiated at Wynaad—Injection of CS2 or Killoptera

into the borer holes was found effective against the grubs of these borers, but the problem has to be further pursued to make it a positive control measure; (4) attempts were made to control the pommegranate borer (*Virachola isocrates*), the plum fruit fly (*Chaetodaccus species*) and the potato tuber moth (*Phohorimoea operculella*) by using DDT and BHC with encouraging results but we have to arrange further confirmatory tests.

Besides the above, the following are some of the more important pests, the control of which is a long range problem and wherein investigations are to be continued :—

(1) The paddy mealy bug (*Ripersia oryzae*).
(2) The paddy gall fly (*Pachydiplosis oryzae*).
(3) Insecticidal methods of control against the redhairy caterpillar (*Amsacta albistriga*).

APPENDIX III.

Programme of Work for 1950–51.

I. Paddy.	
1 The paddy mealy bug (*Ripersia oryzae*).	Comparative merits of scorching the grasses on the nursery bunds, application of DDT and BHC, etc.
2 The paddy stem-borer (*Schoenobius incertellus*).	Observations on the number of emergences and their intensity—spraying the nurseries with BHC and DDT by about the critical period of the emergences and recording the effects on the transplanted crops.
3 The paddy jassid (*Nephotettix bipunctatus*).	Comparartive merits of the lower concentrations of dusts and sprays of DDT.
4 The paddy Cecidomyid (*Pachydiplosis oryzae*).	Comparative merits of dusting DDT and BHC.
5 The field rats (*Gunomys kok, Millardia meltada, etc.*)	General observations on their habits—Detailed investigations of the damage caused by the different species during the various stages of the crops—Perfecting the technique of poison baiting with Zinc Phosphide—Preference of rats to different baits.
II. Millets.	
1 The cholam fly (*Atherigona indica*).	Studies on the bionomics and control of the pest at the Agricultural Research Station, Siruguppa.
2 The cholam stem-borer (*Chilo zonellus*).	Biological control with Trichogramma.
3 The cholam shoot bug (*Perigrinus maidis*).	Comparative merits of DDT and BHC dusting.
III. Sugarcane.	
1 The sugarcane borers (*Argyria, Diatroea and Scirpophaga sp.*)	General observations on the influence of weather factors on the pest—Mortality and compensation indices studies as per the I.C.S.C. scheme.
IV. Oilseeds.	
1 The coconut caterpillar (*Nephantis serinopa*).	Biological control—improving the technique of rearing parasites under laboratory conditions.
V. Cotton.	
1 The cotton leaf roller, boll worms, Aphids, jassids, etc. (*Sylepta derogata, Earias* and *Plytyedra sp. Aphis gossypii, Empoasca devastens*).	Trials with Agrocide cotton dust.

VI. Vegetables.

1 The potato tuber moth (*Phthorimoea operculella*).	DDT and BHC spraying trials at the Agricultural Research Station, Nanjanad.

VII. Fruits.

1 The fluted scale (*Icerya purchasi*).	Breeding and liberation of the predatory beetle—***Rodolia cardinalis*** on the Nilgiris and Kodaikanal—Improvement in the rearing technique—Observations on alternate host-plants, distribution, influence of weather factors, other natural enemies, etc.
2 The san jose scale (*Quadraspidiotus perniciosus*).	Trials with mineral oil sprays—Sandolin A and Euphytan—winter as dormant sprays.
3 The fruit fly on plums (*Chaetodacus sp.*).	DDT and BHC spray at periodical intervals—Pomological Station, Coonoor.
4 Orange borers. (*Chelidonium sp.* and *Chloridolum sp.*).	Comparative merits of DDT and BHC spray and a few other chemicals—Mechanical methods of control like dipping affected tips—injection of Carbon-di-sulphide, Chlorosal, etc.
5. The ber fruit fly (*Carpomyia vesuviana*).	Confirmatory tests with DDT and BHC sprays at intervals of 21 days at Panyam.
6 The pomegranate borer (*Virachola isocrates*).	DDT and BHC spraying trials.
7 The mango hopper (*Idiocerus sp.*)	Large scale comparative trials with DDT and BHC, sulphur combinations both as dust and spray.
8 Mealy bugs and scales on Guava. (*Pulvinaria psidii* and *Leconium viride*).	Spraying trials with DDT., BHC, HETP and comparison with FORS.
9 Mealy bugs on sapota (*Phenococcus sp.* and *Pseudococcus sp.*).	Do.

VIII. Betelvine.

1 The betelvine bug (*Disphinctus politus*).	Dusting DDT and BHC at 3 and 5 per cent concentrations.

IX. Stored Products Pests.

1 Viability of seeds	The effects of mixing DDT and BHC with seed material to note the effects on the viability as well as immunity against insect damage.

X. Cattle pests.

1 Cattle and domestic flies (*Musca nebulo, Stomoxys calcitrans, etc.*).	Action of DDT and BHC against the younger stages in their breeding ground.

XI. Bee-keeping.

Selection and improvement of hives—Swarm prevention study of bee enemies.

XII. Insecticidal trials.

(i) Trial of patent insecticides and fumigants—Comparative merits of the more important insecticides like DDT, BHC, HETP in the control of aphids and coccids in general.

(ii) Lab. Trials—Investigations on the lethal action of DDT and BHC on insects.

(iii) Residual effects of DDT and BHC on insects under laboratory conditions.

XIII. Systematic work.

Collection and systematic study of important groups of insects.

APPENDIX IV.

Statement showing the total number of sanctioned posts of officers and staff in the Office of the Government Entomologist, Agricultural College and Research Institute, Coimbatore, as on 30th June 1950.

	Number of sanctioned posts.	
	Temporary.	Permanent.
I. Madras Agricultural Service—		
Government Entomologist	..	1
Assistant Entomologist	..	2
II. Madras Agricultural Subordinate Service—		
Assistants in Entomology	1	10
Fieldmen	..	4
III. Madras General Subordinate Service—		
Laboratory attenders	1	4
Insectary attender	..	1
IV. Madras Ministerial Servic —		
Lower division clerks	2	2
V. Madras Inferior Service—		
Peons	1	6

List of permanent posts located in the districts.

Plant quarantine scheme.	Number.	Headquarters.
I. Madras Agricultural Subordinate Service—		
Plant Quarantine Inspector	1	Shembaganur.
Do.	1	Mettupalayam.

List of other temporary posts located in the districts.

Rodolia Breeding scheme.	Number.	Headquarters.
I. Madras Agricultural Service—		
Assistant Entomologist	1	Fernhill.
II. Madras Agricultural Subordinate Service—		
Assistant in Entomology	1	Kodaikanal.
Fieldmen	3	Fernhill.
Do.	2	Kodaikanal.
III. Madras Ministerial Service—		
Lower Division Clerk	1	Fernhill.
IV. Madras Inferior Service—		
Peon	1	Fernhill.

ORANGE BORER SCHEME.

I. Madras Agricultural Subordinate Service—		
Assistant in Entomology	1	Kalpatta.
Fieldman	1	Do.

ADMINISTRATION REPORT OF THE GOVERNMENT MYCOLOGIST FOR THE FASLI YEAR 1359 (1949–50).

DETAILED REPORT.

The report of the work of the section for the year 1949–50 is presented under the following heads:—

1 Diseases of food crops.

2 Diseases of commercial crops.

3 Diseases of fruits.

4 Diseases of vegetables.

5 Agro industries.

6 Grow More Food scheme.

7 Miscellaneous investigations.

8 Teaching.

9 Propaganda.

10 Plant Quarantine, Legislation and Advisory work.

I. Diseases of food crops.

1. *Diseases of rice*—(a) *Blast—Piricularia oryzae*—(i) *Varietal resistance trials.*—Field experiments were conducted at the three different stations, viz. Coimbatore, Buchireddipalayam and Aduthurai to find out the relative resistance of 287 cultures of rice. The cultures included 181 new cultures and hybrid progeny of Co. 4 with others which were being tested for the first time. The rest consisted of material carried over from previous season's trials. The tests were carried out on the same lines as in previous years. The plots were heavily manured and in the absence of natural infection were sprayed with spore suspensions.

The incidence of blast at Coimbatore was negligible as the weather conditions were not favourable for the occurrence of the disease. At Buchireddipalayam the sowings were made in two seasons, early and late. The disease was evident in the late plantings. The list of cultures which exhibited high resistance to blast at Buchireddipalayam is given below:—

TABLE I.—*Cultures of rice which were found to be resistant to blast at Buchireddipalayam.*

Serial number.	*Name of culture.*	*Serial number.*	*Name of culture.*
1	9230	26	6718
2	1768	27	6720
3	6538	28	9183
4	1643	29	9184
5	1621	30	9199
6	1648	31	9233
7	1685	32	9261
8	1687	33	9263
9	1748	34	Co. 15
10	1766	35	Co. 4
11	6533	36	2364
12	6544	37	2356
13	6555	38	2744
14	6558	39	3185
15	6577	40	3273
16	6589	41	3820
17	6606	42	3840
18	6610	43	3883
19	6613	44	3892
20	6617	45	3912
21	6681	46	3941
22	6700	47	8036
23	6701	48	8037
24	6716	49	8348
25	6717		

The disease was evident at Aduthurai also and the cultures exhibiting high resistance are shown below :—

TABLE II.—*Cultures of rice which exhibited resistance to blast at Aduthurai.*

Serial number.	*Name of culture.*	*Serial number.*	*Name of culture*
1	6456	12	8094
2	6457	13	8116
3	6459	14	1560
4	6517	15	I560
5	7180	16	3850
6	7212	17	6891/6
7	7395	18	6891/c
8	7431	19	2483
9	7453	20	2461
10	8014	21	2459
11	8050	22	2456

(ii) *Varietal resistance of exotic varieties.*—In order to evaluate the relative resistance of exotic varieties and cultures of rice to blast, two hundred cultures from the collection of the world varieties available with the Paddy Specialist were sown in small nursery plots and the seedlings sprayed with heavy suspensions of the spores of the fungus. Infection was not satisfactory but only negligible as the conditions were not favourable. Hence conclusions could not be drawn.

(iii) *Studies of the pathogen.*—Isolates of *Piricularia oryzae* obtained from diffierent localities and on different hosts were inoculated on rice plants in the field and those grown in pots. The

experiment was undertaken to find out if any differences existed between them in their pathogenic behaviour. The infection was arratic and negligible. Hence no definite inference could be drawn.

(iv) *Effect of applying graded doses of nitrogenous manures, potash and phosphorus.*—It has been established that increased doses of nitrogenous manures tend to make the plants more susceptible to blast especially the susceptible cultures. To see whether the same holds good with resistant cultures, the experiment was repeated using three resistant cultures. There was no disease in the experimental plots. Increase in yield was proportional to the increase in the dosages of manures. The response to nitrogen was more evident than to the others.

(v) *Factors influencing resistance.*—The resistance to blast exhibited by certain varieties has been attributed to the presence of large numbers of silicated cells in the epidermal layers. Histological studies of the epidermal layers of 20 cultures of rice including resistant and susceptible ones were conducted. The number of silicated cells and stomata per unit area were recorded from leaves of the same age. The results are given in the following table :—

TABLE III.—*Record of the silicated epidermal cells and stomata per unit area.*

Number.	Varieties in the order of resistance to blast disease.	Percentage of rank infection.	Average number of epidermal silicated cells in unit area.	Average number of bull-form silicated cell in unit area.	Average number of stomata in the epidermis in unit area.	Remarks.
1	Co. 4	Nil.	6·35	19·20	3·70	
2	3840	Nil.	5·65	19·40	6·75	
3	3185	0·8	3·70	8·15	4·90	
4	2744	1·0	4·50	15·95	4·00	
5	3273	1·0	1·70	4·00	5·25	
6	2554	1·5	4·10	12·95	6·90	Found susceptible at Buchireddipalayam even though found resistant at Coimbatore.
7	2552	1·6	4·55	18·50	9·90	
8	2380	2·0	1·50	14·50	4·90	
9	8036	2·2	2·40	5·70	2·20	
10	3912	4·5	3·00	14·60	3·20	
11	GEB. 24	12·2	5·05	18·15	5·65	Highly leaf resistant.
12	Adt. 6	13.4	1·90	5·50	10·10	
13	Adt. 4	17·9	0·95	6.05	8·90	
14	Co. 2	18·5	1·70	1·35	6·60	
15	Co. 20	18·9	1·15	9·65	7·90	
16	Co. 10	20·2	2·50	4·85	16·55	
17	Co. 19	24·1	3·10	7·70	10·70	
18	Ptb. 10	29·5	1·30	10·30	11·80	
19	Co. 13	48·1	1·85	5·90	11·10	
20	Adt. 10	73·8	0·40	3·55	12·50	

(b) *Foot rot—Fusarium moniliforme*—(i) *Varietal resistance.*—Ninteen cultures of rice not previously tested for resistance were included in the trails. The seeds were artificially infected with a virulent strain of the pathogen. The results of infection are shown below :—

TABLE IV.—*Percentage mortality of seedlings.*

Lay out—Randomized blocks. Size plot—2′ × 2′
Replications—Four. Date of sowing—31st October 1949.
Number of varieties tested—21.

Number.	Name of culture.	Actual percentage of mortality.	Transformed data.
1	Co. 10	97·3	81·38
2	Adt. 6	71·6	57.8
3	Co. 4	55·1	47·5
4	3912	29·1	32·6
5	2366	26·6	30·6
6	3380	24·8	27·6
7	2744	20·3	26·5
8	3185	20·1	26·1
9	2364	17·0	23·8
10	2559	16·8	23.5
11	3840	13·5	20·5
12	Ptb. 15	9·6	17·9
13	3343	9·3	17·4
14	2554	5·0	15·1
15	Ptb. 16	1·5	6·8
16	Ptb. 3	0·9	4·5
17	Ptb. 6	1·0	4·4
18	Ptb. 4	0·8	3·3
19	Ptb. 5	0·4	3·0
20	GEB. 24	0·2	1·6
21	Ptb. 7	0·2	1·5

Standard error—2·06
Critical difference—5·9
Significance at 5 per cent level—Yes.

(ii) *Mode of infection.*—It is definitely known that spores of the fungus are carried on the surface of the grains and the young seedlings are infected by these. In order to determine whether the fungus can p rsist in the soil and cause infection in the nurseries experiments were laid out in which the soil was mixed with cultures of the fungus before sowing seeds. The results showed that the pathogen did not effect the seedlings through the soil.

(iii) *Fungicidal trials.*—Previous trails had shown that organo mercury compounds used for seed treatment gave satisfactory control of the disease. During the year a few other fungicides and hot water treatment were tried to see their effect.

The relative efficacy of the various fungicides are shown below :—

TABLE V.—*Mortality of seedlings under various treatments.*

Lay out—Randomized blocks. Size of plot—2′ × 2′
Replications—Four. Date of sowing—4th November 1949.
Variety used—Co. 10.

Number and fungicide.	Rate.	Actual percentage of mortality.	Transformed data.
1 Control (No fungicidal treatment).	..	94·0	76·24
2 Hot water treatment	55°C for 15 minutes.	34·8	36·1
3 Spergon	One part of seed dressing for 448 parts of grain by weight.	25·4	30·0
4 Pygon	Do.	15·1	22·5
5 Uspulin	Do.	3·0	9·3
6 Ceresan (Tillantin R)	Do.	1·1	5·6
7 Aagrano	Do.	1·0	4·6
8 Atiran	Do.	0·9	4·5
9 Ceresan (Japan)	Do.	0·9	4·4
10 Agrosan GN	Do.	0·5	3·8
11 Margamma	Do.	0·4	3·0
12 Agrosan 4	Do.	0·3	2·0

Standard error—2·06
Critical difference—5·91
Significance at 5 per cent level—Yes.

Control.	Hot water treatment.	Spergon.	Pygon.	Uspulin.	Ceresan (Tillantin R).	Aagrano.
94·0	34·8	25·4	15·1	3·0	1·1	1·0
					(1)	
					(2)	

Atiran.	Ceresan (Japan)	Agrosan GN.	Margamma.	Agrosan.
0·9	0·9	0·5	0·4	0·3
		(1)		
	(2)			

Hot water treatment with water at 55°C. for 15 minutes does not control the disease. The organic fungicides Spergon and Phygon are much less efficient than the organo mercury compounds.

(c) *Stem rot—Sclerotium oryzæ.*—This disease is prevalent in Tanjore and neighbouring districts. The fungus associated with the diseases was isolated and brought into pure culture. It produced sclerotia and conidia (*Helminthosporium sigmoideum*) in cultures. Inoculations were carried out on healthy plants of Co. 19 with the sclerotia and the conidia. Positive infection was obtained with both the stages.

2. *Sorghum diseases*—(*a*) *Rust—Puccinia purpurea.*—The incidence of this rust was low at Coimbatore during this year owing to the dry conditions prevalent. The cultures of sorghum grown at the millets breeding station were periodically examined. It was found that the cultures of *Sorghum caffrorum*, *S. caudatum* and *S. nigricans* exhibited high field resistance. Several cultures have been selected for further trials.

The teliospores of the rust were produced only in the cold months of November and December. They germinated readily in sugar solutions. These were inoculated on *Ipomaea pes-escarpe*, *I. reptans*, *I. sepiaria*, *Heliotropium indicum* and *Wedelia corymbosa* to find out whether any of these plants served as an alternate host to this rust. No case of infection was noticed.

(*b*) *Long smut—Tolyposporium ehrenbergii*.—This smut has become common in Ramanathapuram and Mathurai districts in Chithrai cholam crop. The vellai variety is mostly infected while "Irungu" is free. The mode of infection was not known till now. Inoculation experiments were carried out on the ears of sorghum at different stages, viz., when the flower opened, when the ears had emerged from the sheath and when they were still enclosed inside the sheath. Successful infection was obtained when the ears were inoculated while still enclosed in the sheath. Inoculations carried out in the months of April, May and November were not successful. In March and October the highest infection was obtained. At Coimbatore the cultures Co. 10, Co. 11, As. 7571 and 7589 were found to be easily infected. The spores retained their viability for over a year as was evident from the germination tests carried out every month.

3. *Cumbu* (*Pennisetum typhoides*)—*Rust—Puccinia penniseti*.—The cultures of cumbu grown at the Millets breeding station were periodically examined. The incidence of rust was very low. Inoculations were carried out with this rust on healthy plants of *Pennisetum purpureum*. But no infection took place. Observations on this host growing near cumbu fields also showed that the plants were free from rust. Several grasses, viz., *Brachiaria ramosa*, *Echinochloa colona*, *Cenchrus setigerus*, *Cyperus rotundus*, *Cynodon dactylon*, *Sporobolus tremulus*, *Sporobolus coromandelianus*, *Choris barbata* and *Eragrostis* sp. were also inoculated to note whether any of them served as collateral hosts. Not one was infected.

4. *Wheat* (*Triticum spp.*)—*Rusts*—Black rust (*Puccinia graminis*), yellow rust (*P. glumarum*), brown rust (*P. triticina*). The cultivation of wheat during the months April to September has been banned all over the State with a view to reducing incidence of black rust on the wheat crop in Peninsular India. The basis for this is the belief in some quarters that the Nilgiris and Pulneys form the foci of infection. This belief has not been borne out by the observations made. Black rust appeared in Coimbatore during December while it was recorded on the Nilgiris two months later. If the theory were correct it should have been noticed earlier on the hills. Furthermore the variety of wheat grown on the hills is *Triticum dicoccum*, Samba wheat, which is highly resistant to black rust.

During the year five rust resistant varieties of wheat were obtained from Australia and grown on the Nilgiris. The varieties came up well and in spite of the failure of the north-east monsoon

gave good yields. All of them were free from black rust while an adjacent plot of *Triticum vulgare* had rust incidence. The performances of these varieties grown in plots of same size are given below:—

TABLE VI.—*The reaction and yield of the rust resistant varieties.*

Variety.	Grain yield in pounds.	Resistance to rust, etc.
Gabo	36	Free from all rusts, best growth.
Charter	27	Stray incidence of flecks—Free from black and yellow rusts.
Kendee	25	Free from all rusts.
Celebration	15	Do.
Yalta	12	Stray flecks—No black or yellow rusts.
Local samba	24	Brown rust

The seeds have been preserved for further trials.

Yellow rust was observed in some plots at Kodaikanal. The rust had passed on to *Bromus catharticus* growing in the edges of the plots.

The rusts of *Vulpia myuros* and *Briza minor* were identified as *Puccinia graminis*. Cross inoculations were carried out with the rusts of these hosts and wheat. The results showed that each rust was parasitic on its own host and it did not pass on from one host to another.

5. *Tenai* (*Setaria italica*)—*Rust—Uromyces setariaeitalicæ*.—The varietal plots at the Millets breeding station were periodically examined. The incidence of rust was negligible, and hence the relative resistance of the cultures could not be evaluated

II. DISEASES OF COMMERCIAL CROPS.

1. *Cotton—Black-arm—Xanthomonas malvacearum*.—The field experiments to evaluate the relative resistance of the selected cultures were laid out at the cotton breeding station in co-ordination with the Cotton Specialist. 33 cultures were included. The plants were sprayed with bacterial suspensions when the plants were six-weeks old. The incidence of angular leaf spot and black-arm were recorded. On statistical analysis it was found that the culture 458–1 was the best. Some of the progeny of the culture 79–2 were infected to the same extent as the controls while others were resistant.

2. *Cardamom research*.—A scheme partially financed by the Indian Council of Agricultural Research has been in operation for the last six years. Most of the work connected with the work is carried on at Singampatti, Tinnevelly. Varieties raised from rhizomes alone are grown at Valparai Anamalais.

Botanical studies on the tillering habit, root development, morphology of the leaves, etc., are in progress. A survey had been made of all the important cardamom areas and seeds of the various types had been sown at the Singampatti and the rhizomes planted at Valparai. The plants raised from these have just commenced

to flower. Some of the promising selections of cardamoms taken over from the Bombay Burmah Trading Corporation were planted in the multiplication plots for distribution. Several crosses have been effected. The seeds formed in the successful crosses have been sown.

The studies on the biology of the thrips infesting cardamoms were continued. Nicotine sulphate spray and gammexane dusting were found to give satisfactory control of the thrips.

Experiments on the effect of light and shade on the germination of seeds have shown that short rain-proof pandals erected over the nursery beds are better than long ones. Higher germination is evident under the former. Scarification of the seeds before sowing increases the percentage of germination.

3. *Pepper research.*—A new scheme has been commenced for the improvement of the pepper crop and investigation of the diseases and pests affecting the crop. The research station is to be located at Mattanur, North Malabar. Land acquisition proceelings have been initiated. The survey of pepper gardens in and around the area is in progress for the selection of the varieties and the study of the local methods of cultivation.

III. Diseases of fruits.

Orange (*Citrus reticulata*)—*Decline disease.*—A scheme partially financed by the Indian Council of Agricultural Research is working at Kalpatta in Wynaad to investigate the decline disease of oranges prevalent in the area. A survey of several gardens in Wynaad was made to note the correlation between the incidence of decline and the location of gardens, cultural operations, manures, etc. It was found that the disease was more in gardens on southern and western slopes. Wherever the soil was shallow and covered by grass with unlimited cattle grazing the incidence of the disease was very high. The growers do not usually manure the trees. During the heavy rains erosion and leaching of nutrients are unavoidable as there is no cover for the soil nor are any soil conservation operations carried out. In some of the small holdings where the trees are regularly manured and which are protected from cattle tresspass, the incidence of the disease is nil. The main defect appears to be lack of attention and manuring in the bigger orchards.

Inoculation studies.—Three fungi had been isolated from the dying roots of diseased trees. These are *Rhzoctonia bataticola*, *Fusarium solani* and *Diplodia* sp. These fungi were inoculated on the roots of healthy plants unwounded and after wounding. The infection was more in wounded roots than in unwounded roots. But even here it was erratic. The same organism was not reisolated from the affected roots in many cases. Therefore the pathogenicity of the isolates appears to be doubtful.

Field experiments.—With the co-operation of some of the growers, field experiments were laid out in existing orchards to note the effect of cultural and manurial treatments on the disease. Leaf mulch was applied round the base of the tree and compared with the mammutty digging usually adopted by the growers. It was found that the mulch helped to maintain the moisture in the soil and the trees had improved in the quantity for the foliage and green colour. Trees supplied with manures (made up of cattle manure, potash, groundnut cake and super phosphate) exhibited better condition and improvement, whereas the control trees had yellowing and mottled leaves. Twenty pounds of lime applied to each tree had a beneficial effect. The response was so conscioucous that some of the growers readily adopted this practice in their gardens. *Pueraria Javanica* formed a good ground cover and remained green even during summer. The trials to establish shade trees by planting dadap cuttings were not successful.

Application of bordeaux mixture to the soil round the trees or replacing the soil at the base with a mixture of lime, sand and copper sulphate did not produce any beneficial results.

Orange decline in Kookal valley.—A similar disease was prevalent in Kookal valley also. Preliminary investigations had shown that this was associated with deficiency of nutrient elements. In order to remedy the defect spray application of dilute solutions of the deficient elements was made on the foliagein addition to the soil application of cattle manure, in a private garden at Kookal valley. In spite of the severe summer and failure of the north-east monsoon the treated trees have green foliage while the controls were yellowish with pronounced defoliation. A similar experiment was carried out in Wynaad also. Here too the leaves which were originally mottled turned green and the trees improved in condition. These show that the nutrient requirements of the trees are not kept up with the result that the trees gradually decline in health and become infected by weak parasites.

IV. Diseases of vegetables.

(*a*) *Fusariosis of vegetables.*—Brinjal (*Solanum melongena*), cluster beans (*Cyamopsis tetragonoloba*) and chillies (*Capsicum annuum*) are often affected by wilt disease. Invariably *Fusarium* has been isolated from the roots and collar of the affected plants. Inoculation experiments with the different isolates were made on the respective hosts. When the soil is mixed with cultures grown on host material successful infection was obtained in each case. The effect of growing the plants in various nutrient solutions on the intensity of infection is under investigation.

(*b*) *Spergon treatment of peas and beans.*—Seeds of peas and beans were dressed with Spergon and sown at the Agricultural Research Station, Nanjanad. No difference in the percentage of

germination was evident. The plants were observed during their growth and no appreciable difference in height or size could be made out. The yield figures also did not exhibit any advantage. Probably under Nilgiri conditions Spergon treatment does not produce any favourable effect.

(c) *Club root of cabbage and cauliflower*.—This disease is common on the Nilgiris. Experiments to note the effect of soil application of mercuric chloride solution and cyclosan on the control of the disease were laid out in two places near Ootacamund. Though there was improvement in the germination of the seeds in the initial stages no definite conclusions could be drawn as the incidence of the disease was almost nil in the experimental plots. Hence the effect of the treatments could not be correctly gauged.

V. Agro-Industries.

1. *Ergot of rye* (*Claviceps purpurea*).—The production of this drug was continued on the Nilgiris. A total area of 96 acres was sown to rye. Owing to the lack of attention on the part of the growers over three acres did not come up. The rest of the area was sprayed. The production of ergot was however very low. The north-east monsoon was a failure. High winds and erratic rainfall were prevalent during the south-west monsoon. These contributed to the low yield of ergot. The total yield was about 166 pounds.

During the current season 49 acres have been sown to rye. The sowings were delayed owing to the non-receipt of rains.

Disposal of ergot.—There was great demand for the ergot from private firms. But only a small quantity was sold. The rest of the stock amounting to 600 pounds was sent to the Medical Stores Depot at Madras for being processed into ergot preparations.

2. *Food Yeast* (*Torulopsis utilis*).—The pilot plant erected for the production of yeast was worked for 276 days during the year. A total output of 1,788 pounds of yeast was obtained. Most of this was despatched to the Government hospitals.

Different methods of clarification of the molasses were tried. But it was found that the lime process yielded a product of satisfactory colour and the yeast produced on this wort was better in colour and flavour than the others.

The sugar content of the wort was varied from 0·5 per cent to 1 per cent. Judging from the yield of yeast the optimum was found to be at 0·6 per cent level.

The quantity of seed yeast added to the wort at the beginning of fermentation affects the yield. A seed rate of 1 per cent of wet yeast by weight was found to be the best. The roller drier was used for drying the yeast cream. The product was found to be superior to the oven dried one.

VI. Grow More Food Scheme.

The Plant Protection staff were busy attending to the control of the diseases affecting food and other crops.

The resistant strains of rice were distributed over 44,000 acres in Tanjore and other districts in order to control the blast disease. The resulting crops were free from disease and gave higher yields than the local strains. Several acres of rice and ragi nurseries were sprayed to control the nursery phase of blats disease. Seed dressing with Agrosan GN was carried out over a large area for the control of foot rot and helminthosporiose. Over 45,000 acres were sown to treated seeds. Nearly five lakhs of acres were sown to sorghum which had been treated with sulphur for the control of grain smut. Tenai seeds to cover over 16,000 acres were also treated for controlling smut. Large areas of onions and chillies were sprayed with Bordeaux mixture to control blight and fruit rot respectively. Potato fields were sprayed for the control of early blight.

Large-scale spraying of oranges, limes, turmeric, tobacco nurseries, melons and other crops were carried out. The correct method of preparation of the fungicides was demonstrated to the ryots in various districts.

VII. Miscellaneous Investigations.

1. *Cinchona diseases.*—The cinchona plantations on the Anamalais were inspected periodically. Damping off of seedlings caused by *Pythium vexans* was common and this was easily controlled by spraying the nursery with Bordeaux mixture, Stem canker, foot rot and root rot caused by *Phytophthora cinnamomi* occurs during and after the South-West Monsoon. The fungus infects the seedlings and cuttings causing casualty in the propagation beds. Inoculations were carried out with pure cultures of the fungus on seedlings and cuttings. In both cases successful infection was obtained. In order to control the disease in the field large scale spraying of the stem of cinchona trees was carried out before the monsoon. The plots are under observation. The disease has not occurred so far in them.

Die back of cinchona is evident after the rains. *Corticium salmonicolor* is responsible for the disease. Pruning the affected branches and spraying Bordeaux mixture on the stem will control the disease.

2. *Wilt of casuarina—Trichosporium vesiculosum.*—This disease is common in the coastal districts where the plantations exist. The fungus has been recorded on dead plants. It was believed that this does not cause the disease but comes in later. Pure cultures of the fungus were prepared and inoculation experiments were conducted at Coimbatore. All the inoculated trees were

parasitized and they all died in the course of six months. The same fungus was found on the dead trees. This proved that this fungus is really responsible for the disease but is slow in action.

3. *Rhizome rot of ginger.*—Experiments were conducted at the Agricultural Research Station, Taliparamba to note the effect of treating the rhizomes before planting and application of phosphate manures on the development of the disease. The counts of diseased plants were recorded. The growth of the crop was poor owing to lack of rains and the incidence of the disease was low and of the same intensity in all the plots.

Another experiment has been laid out at the Agricultural Research Station, Pattambi to observe the effect of treatment of planting holes with several fungicides and application of different manures. The germination counts were made. Highest germination has been observed in plots treated with cheshunt compound and perenox. Bordeaux mixture has not been satisfactory. Further observations are in progress.

4. *Edible mushroom—Volvaria diplasia.*—The cultivation of this mushroom is becoming popular. The demand for pure culture spawn is coming in from all over India. Therefore large numbers of bottle spawn are prepared and kept ready for sale. During the year 179 bottles were sold.

5. *Ergot on Paspalum scrobiculatum—Claviceps paspali.*—The wild type of this cereal was affected by ergot during the year. The fungus easily passed on to the cultivated type also. The spread of this fungus should be guarded against as it is poisonous to stock and man.

6. *Agri tree killer solution.*—This preparation has been found by the ryots to be very effective in destroying *Morinda* plants from cultivated fields. Hence the demand for this is increasing from all over the state and even from outside. Engineering authorities and devasthanam officials are also indenting for this. Eighty-three gallons of the solution were sold during the year.

7. *Systematic mycology.*—Several new collections and unnamed specimens in the herbarium were critically examined and the fungi identified. Several new species and one new genus were described. An annotated list of fungi collected from Madras and neighbouring states was written up and submitted for publication.

8. *Hormone weed killers.*—Feronoxone. Field experiments were conducted utilizing this preparation for the control of *Striga lutea*. A solution of 0·2 per cent strength brought about the complete destruction of the parasite without affecting the sorghum crop.

VIII. Teaching.

Forty-one lectures were delivered and fifty-four practical classes were conducted in Mycology and Plant Pathology for the students of the B.Sc Ag. class. The students of the diploma and certificate

courses in horticulture were given lectures and demonstrations on the diseases affecting fruits and vegetables, and their control. The Probationery District Agricultural Officers were given training in the identification of important diseases and the measures to be adopted for their control. Specimens of diseased plants, pure cultures of fungi, and type specimens were supplied to various institutions.

IX. Propaganda.

Special charts and posters were prepared and exhibited at important exhibitions. Articles and notes on the control of important diseases were contributed to the departmental publications.

X. Quarantine Legislation and Advisory work.

Consignments of seeds and plant products intended for export were examined and phytosanitary certificates issued whenever they were found to be free from disease causing organisms.

The Madras Agricultural Pests and Diseases Act was enforced in respect of the following diseases :—

(1) *Wheat rust.*—A ban was imposed on the cultivation of wheat throughout the state from 1st April to 30th September. No special staff was appointed to enforce the ban.

(2) *Bud rot of palms.*—The act was in operation in respect of this disease in the districts of East and West Godavari, Krishna, and three taluks of Malabar. Special staff was engaged in this work.

(3) *Sugarcane smut.*—The act was enforced in Hospet taluk, Bellary district with a special staff.

(4) *Cardamom mosaic.*—Entry of cardamom rhizomes into the Nelliampathis was prohibited. No special staff has been sanctioned.

(5) *Spike disease of sandal.*—Salem district was the notified area.

One hundred and seventy-six specimens were received and examined during the year. Suitable remedial measures were recommended. A number of estates and plantations were visited at the request of the owners for examination of diseases affecting the crop and suggestion of remedial measures.

PROGRAMME OF WORK FOR THE YEAR 1950-51.

1 Studies in Pythiaceous fungi.	The studies on this group of fungi will be continued. Methods of control of cinchona diseases will be investigated.
2 Studies of Phanerogamous parasites.	The study of the host range of orobanche. The use of the new hormone weed killers Agroxone and Feronoxone for controlling striga will be further studied.
3 Rice diseases—	
(*a*) Blast—*Piricularia oryzae*.	The varietal resistance trials will be continued. Besides conducting the trials at Coimbatore the experiments will be laid out at the Agricultural Research Station, Aduthurai and Buchireddipalayam. The influence of different dosages of manures and different levels of soil moisture on the incidence of blast will be further investigated. The study of the isolates from different localities will be carried out.
(*b*) Foot rot—*Fusarium moniliforme*.	The relative resistance of other cultures of rice and the efficacy of new seed dressing substances will be studied.
(*c*) Stem rot—*Sclerotium oryzae*.	The pathogenicity studies will be continued.
4 Ragi blast—*Piricularia* sp.	The resistance of cultures of ragi supplied by the Millet Specialist will be assessed.
5 Cereal rusts.—	
(*a*) Wheat	The search for the collateral hosts for the rusts of wheat will be continued. Further observations and multiplication of the Australian rust resistant varieties will be carried out.
(*b*) Sorghum	The search for alternate and collateral hosts of this rust will be continued. Observational studies on the behaviour of the cultures which were found to be less affected by rust this season will be carried out along with inoculation experiments on seedlings of these cultures.

(*c*) Cumbu rust	The occurrence of collateral hosts will be investigated. Observations on the relative susceptibility of the different cultures grown at the Millet Breeding Station will be made with the help of the Millet Specialist.
(*d*) Tenai rust	The sudies on the relative resistance of different cultures of Tenai will be continued in collaboration with the Millet Specialist.
6 Black arm of cotton *Xanthomonas malvacearum*.	The relative field resistance of the different cultures and selections of cotton to this disease will be further investigated, in collaboration with the Cotton Specialist.
7 Wilt of vegetables	The role of *Fusarium* and *Pythium* isolates in causing wilt will be further studied. The effect of soil treatment on the incidence of wilt will be investigated.
8 Orange diseases	The 'decline of orange' investigation at Wynaad will be continued. The effect of spraying nutrient solutions on the control of the disease at Kookol will be followed.
9 Food yeast	The working of the pilot plant will be continued. Further work on increasing the yield of yeast will be carried out.
10 Edible mushroom	Further experiments on increasing production of the paddy straw mushroom will be conducted.
11 Ergot of rye	Large scale production of ergot and isolation of strains with higher alkaloid content will be pursued. A farm for ergot production has been proposed. If this is sanctioned arrangements for opening the farm will be initiated.
12 Cardamom research ..	The approved programme of the scheme will be followed. The comparative trials of the selections will be conducted. The behaviour of the further selections and crosses will be observed. The various experiments concerned with the raising of healthy seedlings will be put through. The pathological and entomological aspects of the crop will be investigated.
13 Chinchona diseases ..	The effect of bark wash and spray on the incidence of stem canker and crown rot will be studied.

PUBLICATIONS.

The following papers were sent up for publication during the year under report :—

1 Orobanche on tobacco ..	D. Marudarajan—Current Science.
2 Fungus flora of Madras and neighbouring states.	D. Marudarajan and T. S. Ramakrishnan (in the press).
3 Wilt of casuarina	D. Marudarajan, T. S. Ramakrishnan, and C. K. Soumini—Current Science.
4 Additions to fungi of Madras IX.	T. S. Ramakrishnan and K. Ramakrishnan—Proc. Ind. Acad. Science (in the press).
5 Ergot on Bamboo	T. S. Ramakrishnan and K. Ramakrishnan—Current Science.
6 Infection of long smut ..	T. S. Ramakrishnan and G. Siddalinga Reddy—Current Science.
7 Two new rust fungi ..	T. S. Ramakrishna and K. V. Srinivasan, Current Science.
8 Two ergots on grasses ..	T. S. Ramakrishnan and N. V. Sundaram—Science and culture.
9 Two grass smuts	T. S. Ramakrishnan and K. V. Srinivasan—Current Science.
10 Rusts of wheat	T. S. Ramakrishnan—Science and Culture.
11 Black arm of cotton ..	T. S. Ramakrishnan—Indian Phytopathology (in the press).
12 Some new rust fungi from South India.	Do.
13 Two new rusts	T. S. Ramakrishnan—Transactions of the British Mycological Society (in the press).

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I am very grateful to all my colleagues at Coimbatore and the districts for the ready help and co-operation extended. I have great pleasure to place on record the ungrudging help and devotion to duty of the members of my staff.

APPENDIX.

Serial number and name of service and post.	Number of sanctioned posts. Permanent.	Temporary.
I. Madras Agricultural Service.		
1 Government Mycologist	1	..
2 Gazetted Assistant in Mycology	..	1
3 Assistant Mycologist (Paddy Scheme)	..	1
4 Assistant Botanist (Cardamom Specialist)	..	1
5 Paper Specialist	..	1
6 Assistant Mycologist (Ergot Scheme)	..	1
II. Madras Agricultural Subordinate Service.		
1 Upper subordinates	8	7
2 Lower subordinates	..	..
3 Fieldmen	4	6
III. Madras General Subordinate Service.		
1 Laboratory attenders	2	3
IV. Madras Ministerial Service.		
1 Lower division clerks	2	3
V. Madras Inferior Service.		
1 Peons	4	5